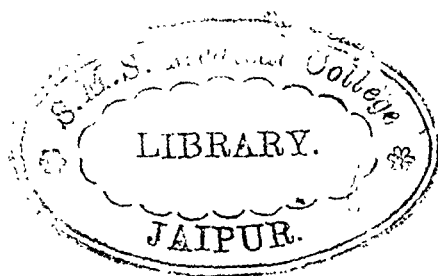
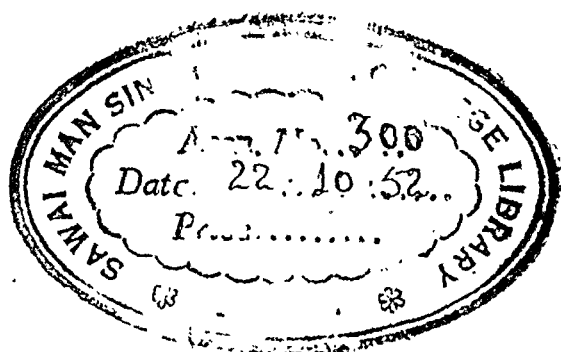


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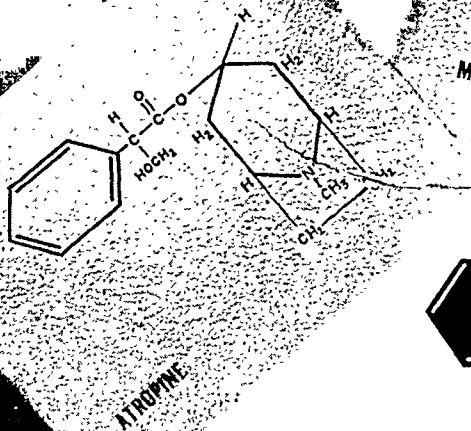
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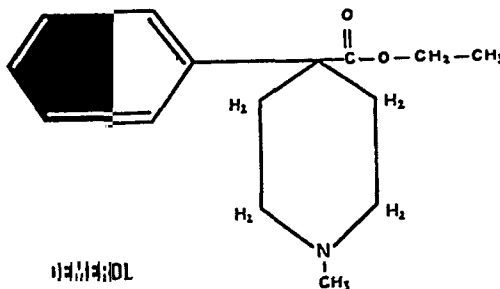
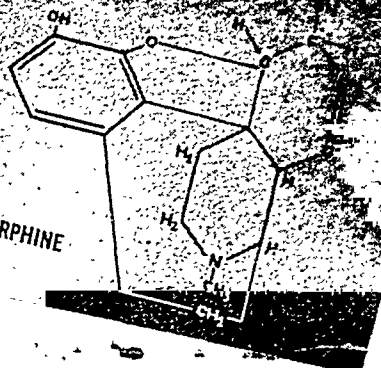
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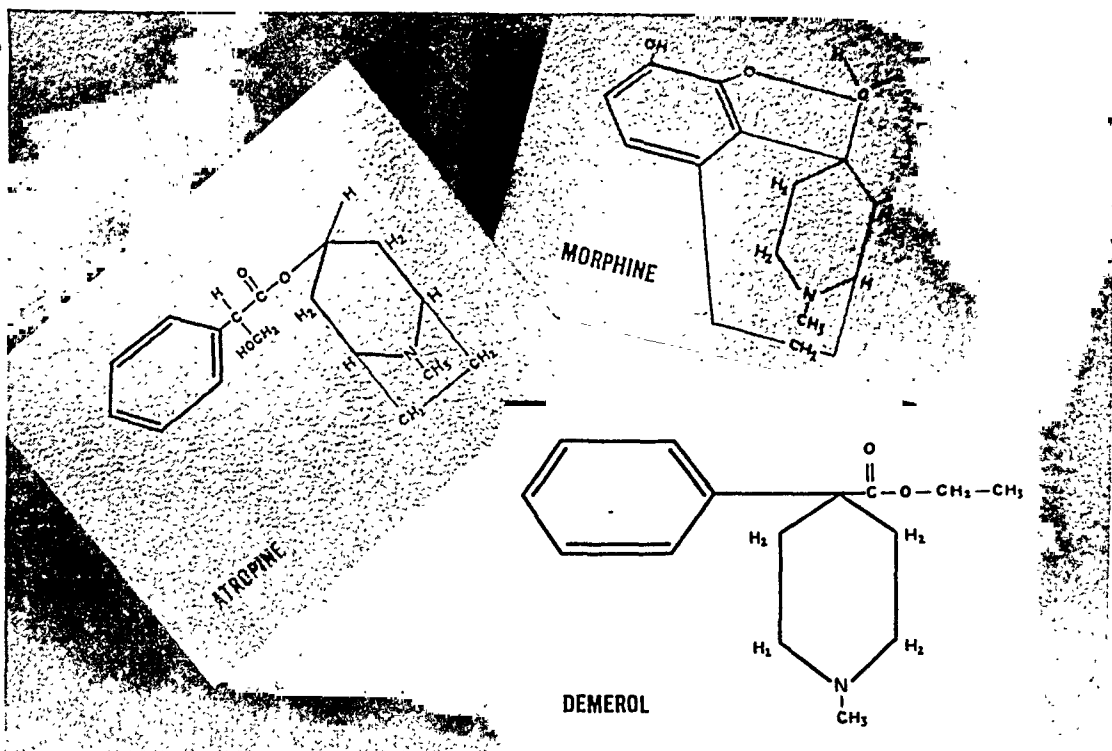
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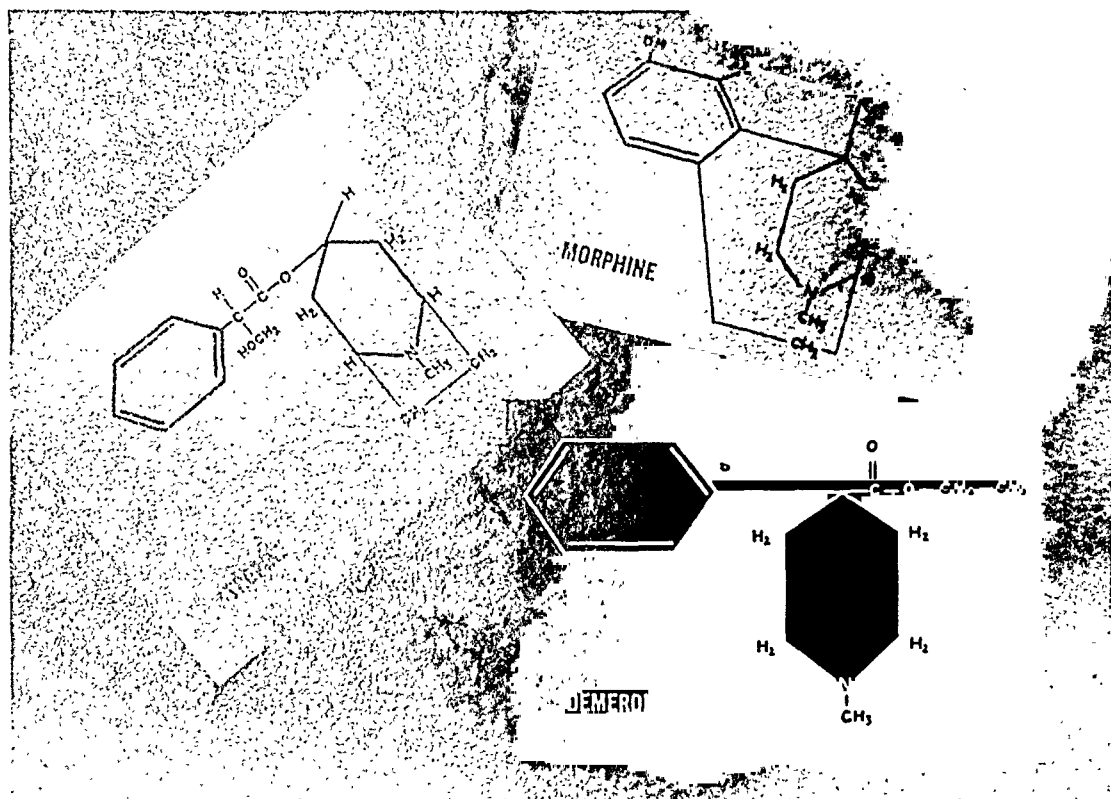
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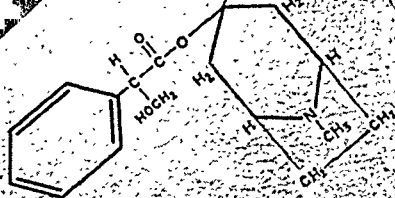
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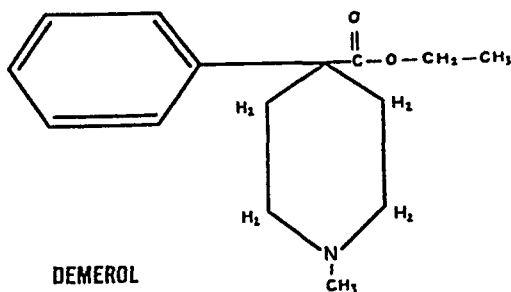
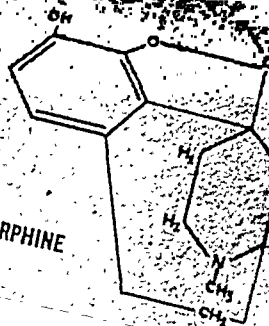
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ATROPINE

MORPHINE



DEMEROL

Chemical Relationship and Pharmacodynamic Similarity

A NEW SYNTHETIC

ANALGESIC

Demerol's analgesic power ranks between morphine and codeine.

SPASMOLYTIC

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SEDATIVE

Demerol's sedative effect is mild, but usually sufficient to allay restlessness and induce sleep.

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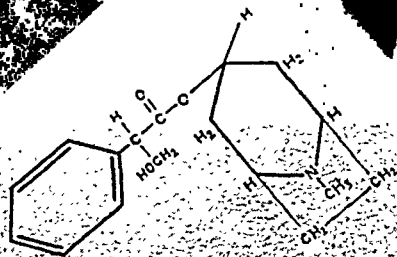
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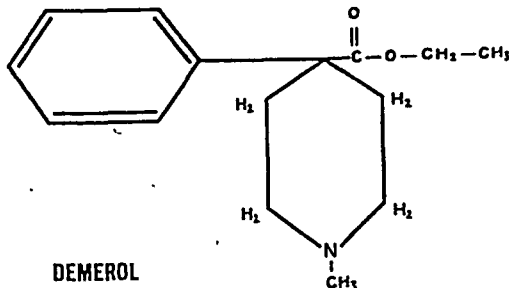
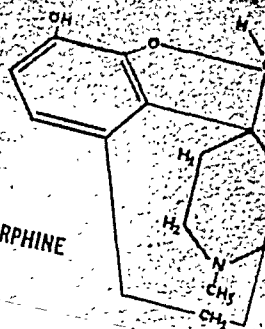
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PERSISTENCE AND HYPERPLASIA OF THE
PRIMARY VITREOUS

(TUNICA VASCULOSA LENTIS OR RETROLENTAL FIBROPLASIA)

ALGERNON B. REESE, M.D., AND FRANK PAYNE, M.D.
New York

This condition, which usually manifests itself as a bilateral congenital lesion of premature infants, has always appeared sporadically, but of late there has been an increased incidence, probably stemming from a lower mortality of premature babies. In the past decade or more, a number of measures adopted by the pediatricians have contrived to save the lives of many premature babies formerly lost. This seems to be an important reason why the lesion under discussion is encountered more frequently now.

We wish to report on 50 cases which, we believe, belong to this group, and the following table shows that the incidence of our cases has been higher during the past decade.

The first reference we can find to this condition dates back to 1851 (Howard¹) and since then many articles have appeared describing various clinical and pathologic aspects of the lesion under various synonyms some of which are as follows: persistent thickened hyaloid artery with secondary changes (Nettleship,² 1873), persistent hyaloid canal and artery (Gardiner,³ 1880), persistence and

thickening of the posterior fibrovascular sheath of the lens (Collins,⁴ 1892; Pollock,⁵ 1923), atypical development of the anterior part of the vitreous with or without a persistent hyaloid artery (Collins,⁴

TABLE 1
YEAR OF BIRTH OF INFANTS IN 50 CASES

	Full-Term	Pre-mature	Total
1930	1	—	1
1931	—	—	—
1932	—	—	—
1933	1	—	1
1934	1	—	1
1935	—	—	—
1936	1	—	1
1937	2	—	2
1938	1	2	3
1939	2	—	2
1940	3	3	6
1941	2	3	5
1942	1	4	5
1943	2	7	9
1944	3	8	11
1945	—	3	3

1892), congenital membrane behind the lens (Parsons,⁶ 1902), persistence of remains of the tunica vasculosa lentis (Bruckner,⁷ 1907), persistent posterior fibrovascular sheath of the lens (Lane,⁸ 1919), persistence of embryonic fibrovascular sheath of the crystalline lens (Lent and Lyon,⁹ 1922), remains of the tunica vasculosa lentis (Gifford and Latta,¹⁰ 1923; Lloyd,¹¹ 1931), pseudophakia fibrosa of Czermak (Fuchs,¹²

*From the Institute of Ophthalmology of the Presbyterian Hospital. Read in part at the eighty-first annual meeting of the American Ophthalmological Society, at Hot Springs, Va., November, 1945.

1923), opaque membrane behind the lens (Collins and Mayou,¹³ 1925), shrunken fibrous tissue cataract (Collins and Mayou,¹⁴ 1925), posterior lenticonus (Collins and Mayou,¹⁵ 1925), congenital connective tissue formation in the vitreous chamber (Collins and Mayou,¹⁶ 1925), posterior polar cataract (Mann,¹⁷ 1937), fibrous tissue cataract (Mann,¹⁸ 1937), persistence of the vascular sheath of the lens (Duke-Elder,¹⁹ 1938), fibroblastic overgrowth of persistent tunica vasculosa lentis (Terry,²⁰ 1942), and retrolental fibroplasia (Terry,²¹ 1942). We believe that all of these references refer to various manifestations of the same basic lesion. Terry, in a series of papers²⁰⁻²⁴ in which he gave the results of his most thorough study of this subject, chose the term "retrolental fibroplasia." This term is acceptable but we feel "persistence and hyperplasia of the primary vitreous" more accurately designates the lesion.

Terry employed the term "retrolental fibroplasia" to designate primarily a condition occurring bilaterally in premature babies after birth (not earlier than four months). He felt that this is a new, acquired condition different from the lesion which is unilateral at the time of birth in full-term infants. From the study of our cases and the literature we do not believe such a distinction is justified but that the same lesion may occur in both premature and full-term babies, that it may be unilateral or bilateral, and that all are congenital but may not manifest themselves until sometime after birth either because they are not looked for or because the lesion progresses.

AGE WHEN ABNORMALITY WAS OBSERVED

The age of the patient when the parents or physician first noted any ocular abnormality is stated in 15 of our records.

In nine patients the lesion was noted during the first week after birth:

<i>Number</i>	<i>Term</i>	<i>Noted</i>
<i>Cases</i>		
1	premature	at birth
3	full-term	at birth
1	full-term	on 2d day
1	full-term	on 3d day
1	full-term	on 4th day
1	full-term	within a week
1	premature	within a week

In six patients the lesion was noted at later dates:

<i>Number</i>	<i>Term</i>	<i>Noted</i>
<i>Cases</i>		
1	full-term	on 23d day
1	full-term	at 4 weeks
1	full-term	at 5 weeks
1	premature	at 10 weeks
1	full-term	at 4 months
1	premature	at 5 months

The records of the remaining 35 patients in some cases do not state specifically the time at which the parents observed something abnormal about the infant's eyes; in other cases the parents did not notice anything unusual until the baby was three months old or older, although they had suspected for a long time that the baby was not seeing things; however, they did not become seriously concerned until the baby was several months old.

On the basis of the embryology and pathology concerned, which will be discussed later, it is difficult to conceive of the tissue being absent at birth and forming subsequently. We know that remains of the hyaloid system and other congenital abnormalities in the structures of the eye are frequent accompaniments of the lesion. Our thesis is that in these cases the primary vitreous, which is a vascularized mesoderm, persists in some or all of its phases at birth and may show re-

gressive or progressive changes. Progressive changes, from the clinical aspect, may be due to actual hyperplasia of this mesoderm or to secondary factors such as hemorrhage, contracture, swelling of the lens, secondary glaucoma, and corneal opacity from contact of the lens and iris with the posterior surface of the cornea. The nature of these secondary changes will be pointed out when the pathology is discussed.

Prematurity. What constitutes a premature baby is not always clear. For our purposes we have chosen a birth weight of under five pounds or, in instances wherein the birth weight is lacking (15 of our cases), an infant born before a nine-months' period of gestation had been completed to designate prematurity. This criterion divided our 50 cases as follows:

30 (60 percent) were premature infants.

20 (40 percent) were full-term infants.

Laterality. Of 30 premature infants the involvement in 28 was bilateral; in 2 unilateral. In one of these there was a juxtapapillary area of chorioretinal atrophy in the fellow eye. Of 20 full-term infants the involvement in 7 was bilateral; in 13 unilateral. In one of these hydrophthalmos was present in the fellow eye.

Thus, of 50 cases, 35 were bilateral and 15 were unilateral.

Sex and color. Of 50 cases 31 were in males, 19 in females. All patients were white except in 1 case, a Negro.

Twins and Triplets. 3 cases were in twins, 2 cases were in 2 of triplets; the third sibling died at the age of three days and the ocular status was not known.

CLINICAL TYPES

The clinical appearance of this basic condition is varied and depends on several factors: (1) stage of cessation of the normal involution or disappearance of the

primary vitreous including the hyaloid system; (2) amount and character of the hyperplasia of the mesoderm of the primary vitreous; (3) extent and character of the secondary changes (hemorrhage, contracture, glaucoma, swelling of the lens, contact of iris-lens diaphragm with the cornea, and the like).

It is convenient to divide the clinical manifestations into four types as follows:

I. Saucer-shaped, whitish opaque tissue conforming to the posterior surface of the lens (figs. 1 to 5);

II. An opaque cornea, greatest in the central portion, usually associated with glaucoma, and maybe buphthalmos (figs. 6 to 9);

III. A localized area of opaque tissue on the posterior surface of the lens, or at the lens equator, or in the anterior vitreous, with or without retinal detachment (figs. 10 to 14);

IV. Remains of the hyaloid system (fig. 15).

These four clinical types are not necessarily sharply demarcated but may merge. Type I may change into type II, or there may be type I in one eye and type II in the fellow eye. Otherwise one type cannot go over into another type.

Type I. This appears as a concave, saucer-shaped whitish opaque tissue against the posterior surface of the lens (fig. 1). It is the typical and most frequent manifestation of the lesion. The globe is smaller than normal in size, the cornea is clear, and the anterior chamber shallow. The lens is clear, but against the convexity of its posterior surface is applied this whitish tissue whose surface is concave to fit the convexity of the lens. Blood vessels of varying size and number are usually visible in the opaque tissue. The tissue covers the greater part of the posterior surface of the lens, but the central portion is densest and there is a

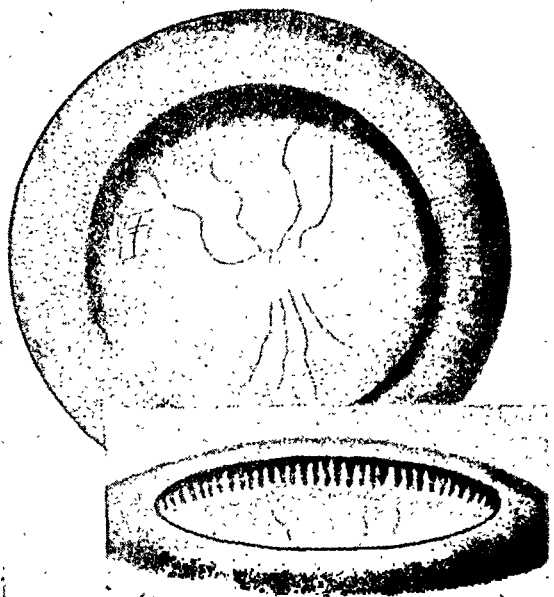


Fig. 1 (Reese and Payne). Clinical type-I lesion. Above is shown the concave opaque tissue containing blood vessels which radiate from the center. The density of the lesion decreases from the center to the periphery, where it is more or less transparent. Below is shown the elongated ciliary processes inserted into the periphery of the retrolental opacity. This is the drawing of the left eye of the twin whose eye is shown in figure 14.

gradual thinning toward the periphery of the lens, where, frequently the fundus reflex, or even some details of the fundus, may be seen. Around the equator of the lens long narrow ciliary processes in one or more sectors can be seen either free or extending into the periphery of the membrane. These processes can usually be seen clinically (figs. 1 and 10) if looked for, and when present they are pathognomonic of this condition.

From this usual, clinical appearance, just described, there may be some variation, discussion of which follows.

The size of the globe was mentioned in the clinical description of 23 cases. Of these, the globes were larger than normal in both eyes in two bilateral cases; the globe was larger than normal in one eye

and smaller than normal in the fellow eye in one bilateral case. In all other cases, the eyes appeared to be smaller than normal. Microphthalmos was present in 7 unilateral cases and 12 bilateral cases. It was present in both premature and full-term infants.

It is felt that the enlargement of the globes was due to glaucoma. We found the intraocular pressure elevated in several cases of microphthalmos according to the tonometric readings. It is difficult to discuss glaucoma in these cases with confidence, owing to the fact that the tonometer discs and footplates are gauged for a normal adult cornea and not for the

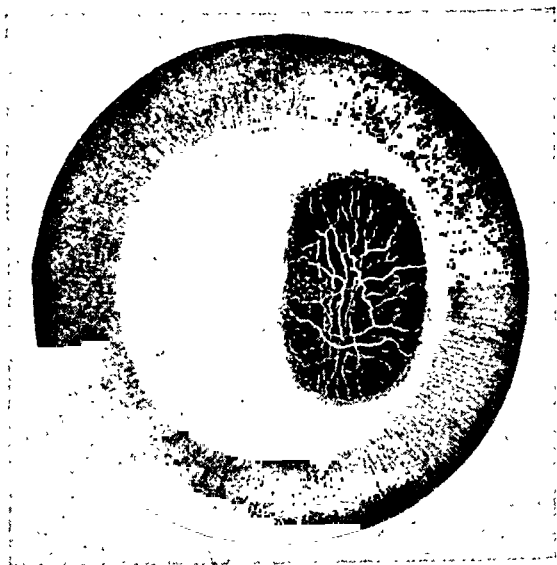
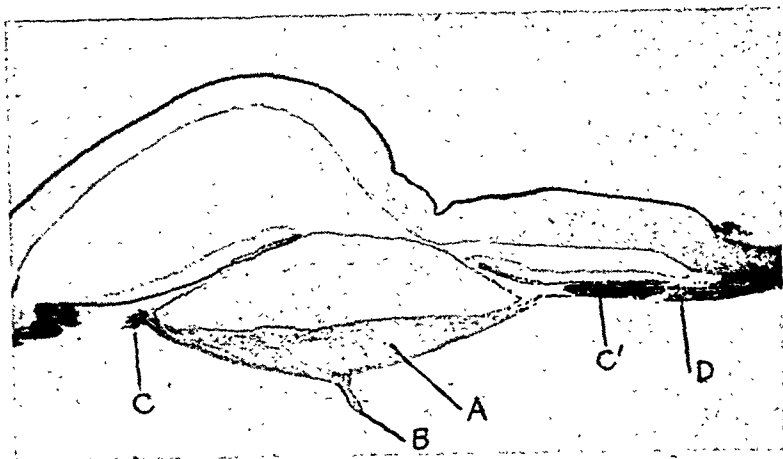


Fig. 10 (Reese and Payne). Clinical type-III lesion without retinal detachment at two days of age (noted by father who is a doctor). At two months of age a hemorrhage was noted over the surface of the lesion and in the course of several weeks this hemorrhage became absorbed. After 1½ to 2 years the blood vessels disappeared, and now, at the age of 5 years, the lesion is the same size, somewhat less dense, avascular, and with a small localized almost chalky-white area interpreted as a focus of calcium deposit. This illustration was made when the patient was nine days old, and shows a vertically oval, whitish-opaque, vascularized lesion located on the posterior surface of the lens. Elongated ciliary processes are seen extending toward the lesion (case of Doctor M. U. Troncoso).

Fig. 2 (Reese and Payne).

A portion of a human eye showing persistence and hyperplasia of the primary vitreous corresponding to clinical type I. The retrolental fibrous mass is shown at A with the hyaloid artery at B. The lens is small. Ciliary processes, C and C', extend to the fibrous mass, and the retina is seen as far as D.



cornea of an infant or for a microcornea. In these cases the determination of the intraocular pressure by palpation is perhaps more accurate than by tonometer. Terry stated that "in spite of glaucoma the eyes have not become enlarged." This has been our experience provided we have been accurate in determining the presence of an increased intraocular pressure. We have the impression, however, that these eyes are not prone to develop buphthalmos in the presence of what seems to us to be a definitely increased pressure.

One of the most important factors in the production of glaucoma is the narrowing of the anterior chamber and blocking of the filtration angle due to advancement of the iris-lens diaphragm. This is produced by (1) swelling of the lens from an opening in its posterior capsule; (2) contracture of the fibrous membrane behind the lens, pushing the lens and iris forward (suggested by Terry in a personal communication); (3) massive hemorrhage in the vitreous. Another factor is the presence of an embryonic filtration angle in some of these cases.

The clinical appearance does not always remain the same but may present a changing picture. The later occurrence of glaucoma is particularly noted, and concurrent with this are usually a decrease or even a disappearance of the anterior

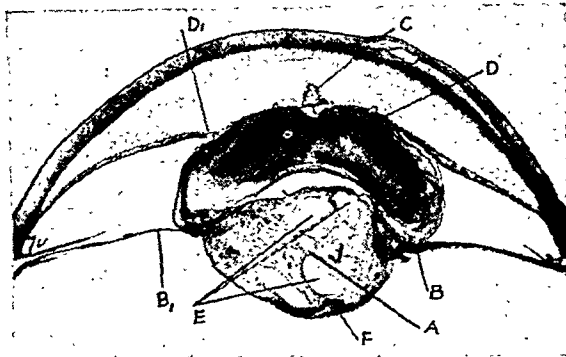


Fig. 3 (Reese and Payne). A section of a human eye showing persistence and hyperplasia of the primary vitreous corresponding to clinical type I. The large retrolental mass, A, extends for some distance forward into the lens, giving the lens a kidney shape. At B and B', rudimentary ciliary processes along with some of the retina extend to the periphery of the mass. An anterior pyramidal cataract is shown at C. A pupillary membrane is seen at D and D'. In the retrolental mass are large areas of cartilage, E, blood vessels, and the tissue at F is thought to be smooth muscle. Peripheral synechiae are present.

chamber, a stippling and opacity of the cornea of varying degree, and cataractous changes.

Hemorrhage may occur from the vessels in the opaque retrolental tissue. We have observed this clinically in three cases.

Typically, the retrolental tissue is concave (fig. 2), but this tissue may be sufficiently hyperplastic to extend into the lens substance and therefore present a

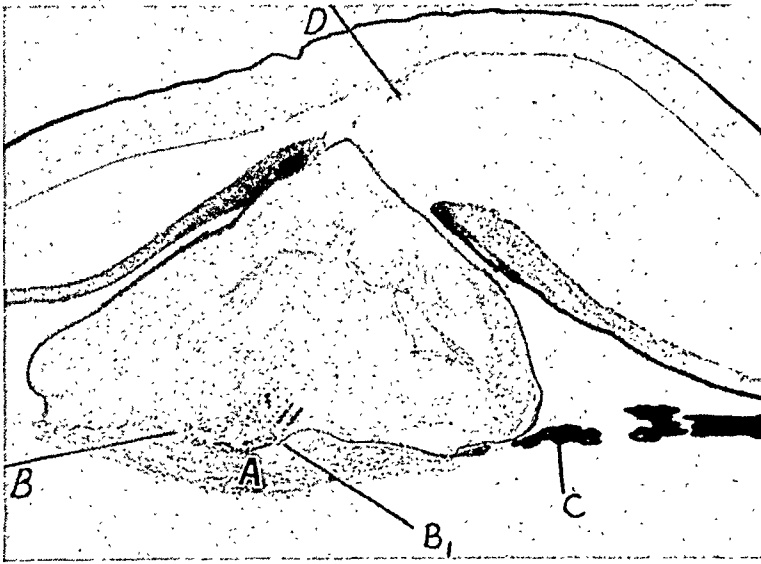


Fig. 7 (Reese and Payne). A section of a human eye showing persistence and hyperplasia of the primary vitreous corresponding to clinical type II. The retrolental fibrous mass is shown at A, and the posterior lens capsule is open from B to B₁. A higher magnification of this site is shown in figure 8. The ciliary processes, C, extend to the fibrous plaque. The lens is swollen and protrudes forward along with the iris to the cornea. *In vivo* the apex of the lens, along with the adjacent iris, rested against the cornea at D (see figure 9).

convex surface (fig. 3). Blood vessels may or may not be seen in the opaque tissue; if present they may disappear in time.

The lens may become cataractous preventing a view of the retrolental tissue. The cataract develops probably because the posterior lens capsule is opened (fig. 7).

Type II. This is characterized by an opacity of the cornea beginning in the central portion and spreading peripherally

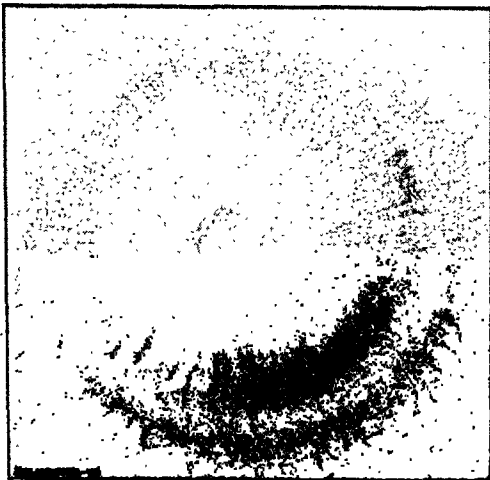


Fig. 6 (Reese and Payne). Clinical type II. The opacity of the cornea is greatest in the central portion. There is diminished luster with stippling of the epithelium. The anterior chamber is absent where the lens and iris touch the cornea and extremely shallow elsewhere.

but always densest centrally (fig. 6). The anterior chamber is absent or shallow. The corneal epithelium shows stippling, more marked centrally and diminishing peripherally. Glaucoma is present and if of long standing there may be buphthalmos.

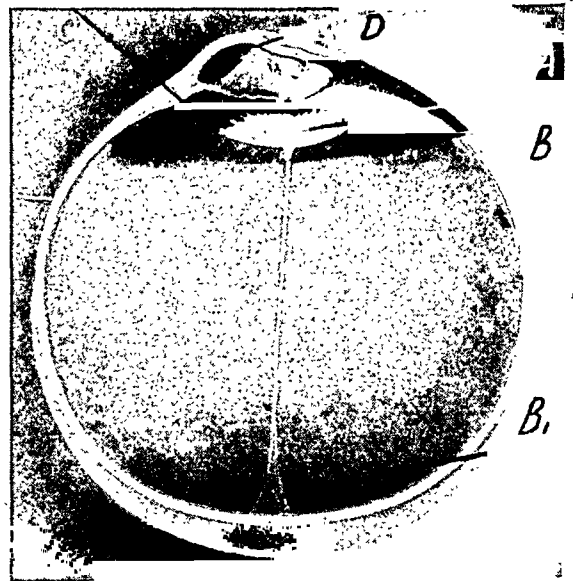
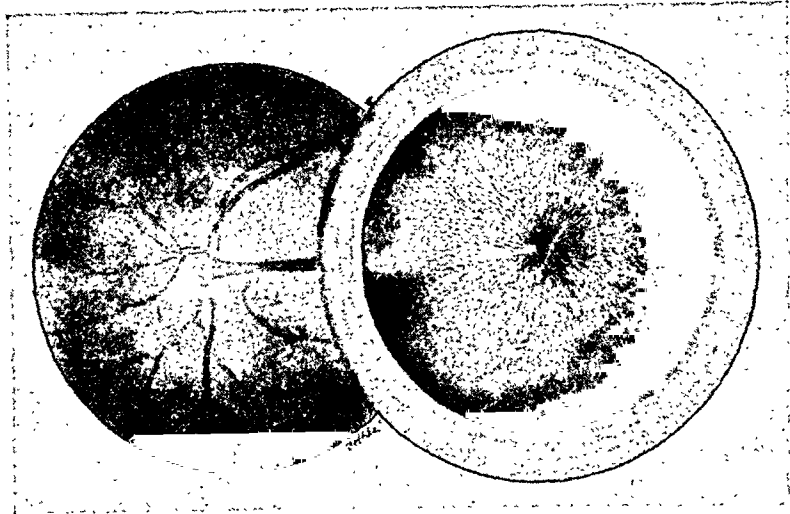


Fig. 9 (Reese and Payne). The gross appearance of the eye shown in figures 7 and 8. One side of the globe has been removed. The retrolental fibrous tissue is seen at A, with the hyaloid artery, B to B₁ coursing from the posterior surface to the disc. The zone of long ciliary processes extending into the retrolental mass is seen at C. The lens and iris extend forward to touch the cornea at D.

Fig. 15 (Reese and Payne). The clinical appearance of a case in which the features of clinical type IV dominate those of clinical type I. The patent hyaloid artery containing blood is seen extending from the disc to the posterior surface of the lens while along the posterior surface of the lens there is a fine lacelike pattern of fibrous tissue which might be interpreted as some persistence of the primary vitreous without hyperplasia. This is in contrast to clinical type I, in which the persistence



of the hyaloid system plays a secondary role. Clinical type IV in its most typical form is persistence of the hyaloid system without the retrolental lesion, just a clinical type I is the retrolental lesion without the hyaloid system (case of Dr. Charles A. Perera).

Type I may develop into type II. The corneal changes which dominate the clinical picture are due primarily to an advancement of the iris-lens diaphragm forward so that some of the iris and lens, and particularly the central portion, are in apposition to the posterior surface of the cornea (figs. 7 and 9). This interferes with the impermeability of the corneal endothelium, permits aqueous to enter the stroma, and produces changes leading to opacification, including pannus formation. The same advancement of the iris-lens diaphragm embarrasses the filtration angle and usually leads to glaucoma. The presence of increased intraocular pressure tends to increase the corneal edema. As previously mentioned in discussing glaucoma, the advancement of the iris-lens diaphragm is due to swelling of the lens, contracture of the fibrous sheath behind the lens, and perhaps intraocular hemorrhage. These factors will be considered further when the pathology is discussed.

The corneal opacity prevents an accurate view of the interior of the eye, and frequently the retrolental fibrous tissue is not visible, especially through the central portion of the cornea. The pres-

ence of a partially or totally cataractous lens adds to the difficulties. This type may occur in premature or full-term infants and may be unilateral or bilateral. When

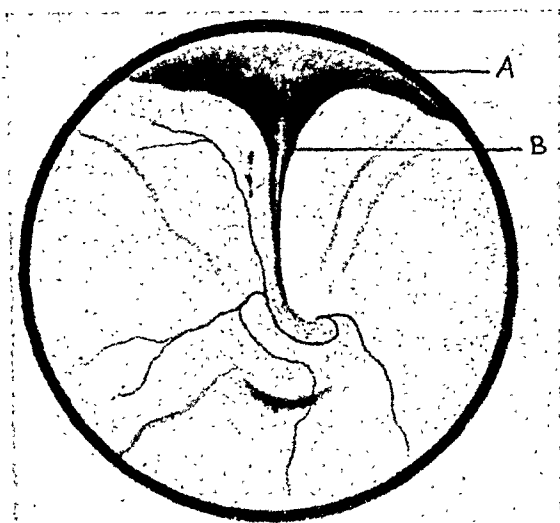


Fig. 11 (Reese and Payne). Clinical type III lesion with retinal detachment. The fibrous plaque of tissue located at the posterior equatorial region of the lens is seen at A, and from it a fibrous extension, B, courses backward to the retina, which is detached. There was a partial coloboma of the optic disc. This patient, who has a similar lesion in the fellow eye, was one of triplets one of whom died and the other had persistence and hyperplasia of the primary vitreous clinical type I in one eye and clinical type II in the fellow eye.

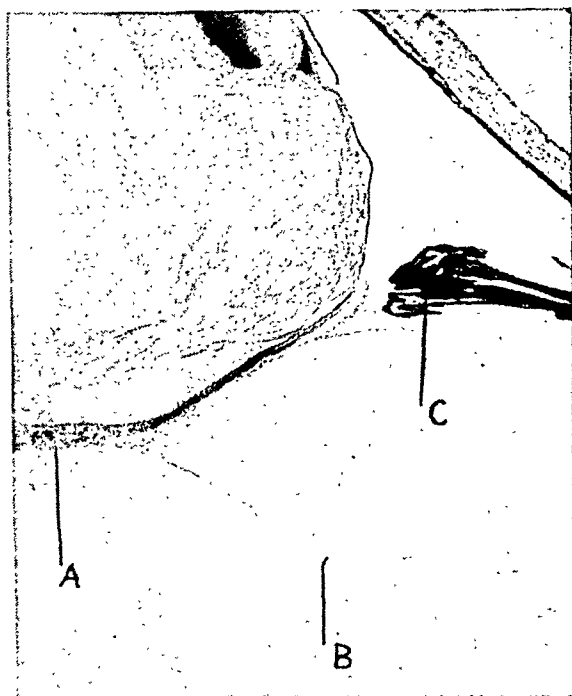


Fig. 12 (Reese and Payne). A section of a human eye showing persistence and hyperplasia of the primary vitreous corresponding to clinical type III. From the retrolental fibrous plaque, A, a strand of tissue, B, crosses the vitreous to attach to the retina (see figure 13). Long ciliary processes, C, extend to the periphery of the retrolental tissue.

type I is present in the fellow eye the diagnosis is easier. This type is easily confused with congenital hydrophthalmos or buphthalmos.

Type III. This is seen as a localized mass of opaque tissue along the posterior surface (fig. 10), or the equator of the lens (fig. 11), or in the region around the base of the vitreous. This tissue may or may not have visible blood vessels, and if blood vessels are present they may in time disappear. Hemorrhage may occur in the tissue. If the lesion is located at the equator of the lens, or in the anterior vitreous around the base, it usually is accompanied by a detachment of the retina (fig. 11) which points toward the lesion; that is, the elevated retina extends toward or into the tissue, and the retina elsewhere may be in good position. A

hole in the retina or a disinsertion may be present. Long ciliary processes point toward the opaque tissue (fig. 10). Strands or fingerlike projections may extend from the mass posteriorly to the surface of the retina (figs. 12 and 13). In one case there was a coloboma of the optic disc.

Type IV. This comprises instances wherein the central portion of the hyaloid system, or the greater part of it, remains with little or no retrolental portion (fig. 15). This group is in contrast to type III, in which a part of the retrolental portion remains but no central hyaloid portion. The hyaloid system is a part of the primary vitreous so that anomalies of the two are associated with perhaps the one or the other dominant in an individual case. Just as there may be, on the one hand, an isolated rest of the primary vitreous on the posterior surface of the

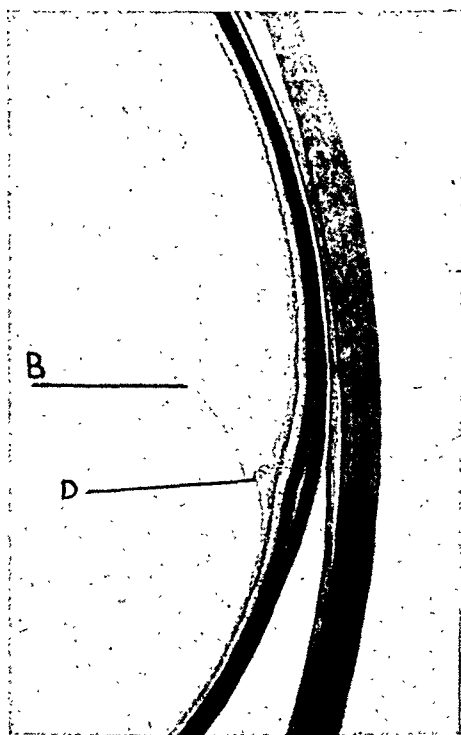


Fig. 13 (Reese and Payne). The fibrous strand shown in figure 12 at B is seen here, B, attaching to the inner surface of the retina, which it is detaching by its pull at D.

lens, so there may be, on the other hand, an isolated remain of the hyaloid artery and all combinations in between the two extremes.

In our series, two particularly interesting cases belong to this fourth type. The one was of a 17-months-old infant who in the right eye had a massive vitreous hemorrhage preventing a view of the interior of the eye. The cause of the hemorrhage could not be determined until complete absorption occurred after several months, when a persistent hyaloid artery was found. The other was a similar case of a three-year-old boy who, on having the left eye bandaged after removal of a foreign body from the cornea, noticed that he could not see with the right eye. Under ether anesthesia, the eye was enucleated with the clinical diagnosis of retinoblastoma. Pathologic examination revealed a vitreous hemorrhage and remains of the hyaloid system; no tumor was present.

In these two cases vitreous hemorrhage occurred from a persistent hyaloid artery and no doubt spontaneously, as we know this does happen in other instances where elements of the primary vitreous persist.

The incidence of the four clinical types in our series of cases was as follows:

DIAGNOSIS

Clinical type I especially can be confused with retinoblastoma. X-ray studies on nine cases were negative for calcium. Transillumination of light is good except in those cases with hemorrhage. The most important diagnostic points are (1) an opaque tissue just behind the lens with a saucer-shaped or anterior concavity; (2) long ciliary processes extending into the retrolental tissue. Retinoblastoma seldom occurs in a microphthalmic eye. Clinical type II can be confused with other types of buphthalmos or with corneal changes secondary to intraocular inflammation. Clinical type III can be confused with massive retinal fibrosis of children secondary to intraocular hemorrhage at birth.²⁵

Type IV can be confused with an intraocular growth when vitreous hemorrhage occurs.

EMBRYOLOGY

The various phases of this basic lesion consist of arrested development, arrested regression, and hyperplasia of the developing vitreous. A review, therefore, of the development of the vitreous is in order.

FIRST PERIOD (up to the 13-mm. stage).
At the 4.5-mm. stage, mesoderm be-

Type I	Type II	Type III	Type IV
16 bilateral 8 unilateral	9 bilateral 1 unilateral	2 bilateral 1 unilateral	3 unilateral
2 bilateral .....later progressed to type II			
4 with type I in 1 eye, and type II in the fellow eye			
2 with type I in 1 eye, and .....type III in the fellow eye			
1 with type I in 1 eye, and .....type IV in the fellow eye			

gins to appear in the space between the lens plate and optic vesicle. This mesoderm is part of the vasoformative cells which will grow in through the fetal fissure to form the hyaloid arterial system.

By the 10-mm. stage large quantities of vascular mesoderm have grown in between the lens vesicle and the inner layer (retina) of the invaginating optic vesicle, forming the hyaloid artery, which is entering the eye through the fetal fissure.

At the 12-mm. stage the vitreous is a mass of fibrils derived from the lens (ectodermal) and the retina (ectodermal) and joining up secondarily with fibrils (mesodermal) from the cells of the wall of the hyaloid artery.

At the 13-mm. stage the hyaline capsule surrounding the lens has completely formed. The lens no longer, therefore, contributes to the formation of vitreous. Vitreous fibrils, remaining adherent to the lens capsule, condense to form a thin fibrous envelope surrounding the lens and containing in its meshes the vessels of the vascular capsule. This fibrous capsule is the capsula perilenticularis fibrosa and originated from the lental part of the primary vitreous.

Development of vessels in the first period. At the 6 to 7-mm. stage the terminal part of the hyaloid artery ends near the posterior surface of the lens plate; it sends capillary branches into the meshes of the capsula perilenticularis fibrosa, forming a vascular net over the posterior surface of the lens. This is the beginning of the tunica vasculosa lentis, and is seen at the 8 to 9-mm. stage.

By the 10-mm. stage these vessels have extended anteriorly to form the lateral (equatorial), or capsulo-pupillary, portion of the tunica vasculosa lentis.

The vitreous as it now exists is known as the primary vitreous. It consists of ectoderm derived from the lens and retina, and of mesodermal vasoformative tissue

which has formed the hyaloid artery, the posterior and lateral portions of the tunica vasculosa lentis (enmeshed in the capsula perilenticularis fibrosa). The formation of the hyaloid capsule at the 13-mm. stage marks the end of the period of development of the primary vitreous.

SECOND PERIOD (12 to 65-mm. stage)

By the 16-mm. stage arterial branches arising from the hyaloid have begun to project into the freshly forming vitreous and are termed the vasa hyaloidea propria.

By the 25-mm. stage the anterior, or pupillary, portion of the tunica vasculosa lentis has formed.

Up to 40 mm. the vitreous (ectodermal and mesodermal) is still full of vessels as far as the periphery; that is, to the internal limiting membrane. The vasa hyaloidea propria have reached their maximum development.

After the 40-mm. stage the smaller vessels in the vitreous begin to atrophy, the portions nearest to the lens remaining visible the longest, with the result that the region nearest the retina becomes free of vessels. This avascular portion is known as the secondary vitreous. Its appearance is due to (1) atrophy of the proximal ends of the vasa hyaloidea propria and (2) further formation of additional vitreous from the retina as the eye enlarges.

There occurs a cessation of growth of the primary vitreous and a continued increase in the amount of secondary vitreous, filling the eye as it enlarges, thus giving a relative, but not an absolute, decrease in the size of the primary vitreous.

The condensation line between the primary vitreous and the secondary vitreous forms the "wall" of Cloquet's canal. In the canal passes the hyaloid artery from the optic disc to the posterior surface of the lens.

The primary vitreous is funnel-shaped,

narrow at the disc, and wide at the lens (fig. 16).

Fate of the posterior portion of the tunica vasculosa lentis and the vitreous vessels.

After the 20-mm. stage, the caliber of the vessels decreases.

At the 60-mm. stage, the vasa hyaloidea propria are the first to show signs of regression; they shrink in caliber first at their proximal ends (at their origin from the hyaloid artery), losing connection with the hyaloid artery. Their distal ends remain attached to the vessels on the posterior surface of the lens and tend to curl up.

By 8½ months, all vessels except the main trunk have atrophied completely.

During the eighth month the main trunk of the hyaloid artery becomes impervious in its central part; atrophy proceeds more rapidly in its proximal portion, so that it loses connection with the disc and floats freely in Cloquet's canal from the posterior surface of the lens; it also tends to curl up. This portion atrophies during the first few years of life.

PATHOLOGY

We have available 17 eyes which contribute to the study of the pathologic processes concerned in the condition under discussion.

I. THIRTEEN EYES FROM THIRTEEN DIFFERENT CASES OF PERSISTENT PRIMARY VITREOUS

A. The retrolental fibrous sheath. Each eye had a fibrous sheath of varied thickness and shape behind the lens (figs. 2, 3, 4, 5, 7, 9, 12). In most instances this sheath conformed to the contour of the posterior surface of the lens but occasionally the sheath was flat and rarely protruded inward, presenting an anterior convexity instead of an anterior concav-

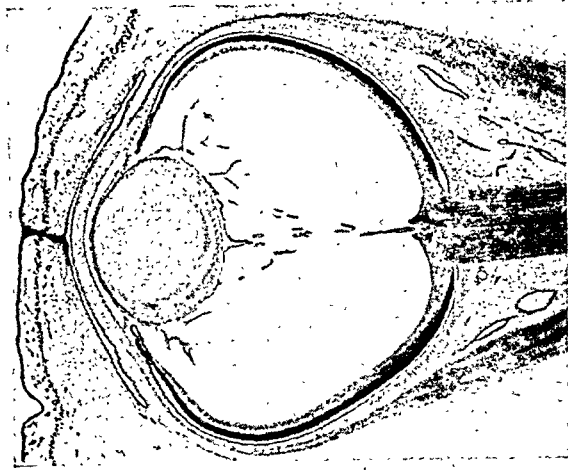


Fig. 16 (Reese and Payne). The primary and secondary vitreous of a 130-mm. fetus as depicted on Tafel XXII in Bach and Seefelder's "Atlas zur Entwicklungsgeschichte des Menschlichen Auges," 1911. The hyaloid system, together with the primary vitreous, forms a vascularized, funnel-shaped zone of mesoderm extending from the retrolental region to the disc.

ity. The sheath was composed mostly of fibrous tissue rather rich in blood vessels. In seven of the eyes there was, along the posterior surface of the sheath, a definite layer which histologically resembled smooth muscle (fig. 8, D). This was thickest at the central area, where it merged with the remains of the hyaloid system when present (fig. 3, F). The staining reaction of this tissue with hematoxylin and eosin was consistent with that of smooth muscle, but with the trichrome stain it took more of a bluish color than adult smooth muscle but less than connective tissue. In three of the eyes, the sheath contained fat (fig. 8, C); in one, large areas of cartilage (fig. 3, E); and in one, an area of tissue interpreted as undifferentiated mesenchyme. Remains of the hyaloid system were noted in four eyes. This consisted of a patent vessel extending from the disc to the posterior central portion of the fibrous sheath. Very long slender ciliary processes extended to the periphery of the sheath in all eyes. These processes were enmeshed in the periphery

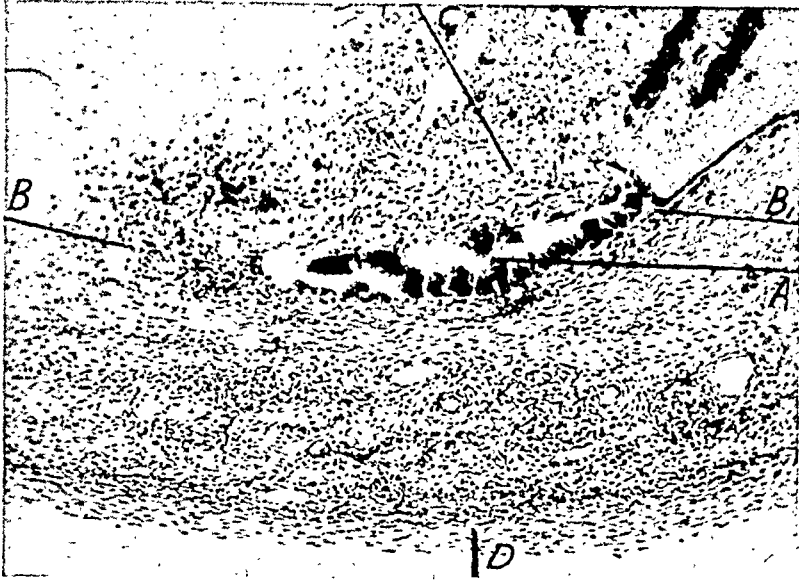


Fig. 8 (Reese and Payne). A higher magnification of the site from B to B₁ in figure 7. The opening in the capsule extends from B to B₁. The darker areas, A, represent calcium. The region designated C is fat, and the layer shown at D is smooth muscle. There are a considerable number of vascular channels.

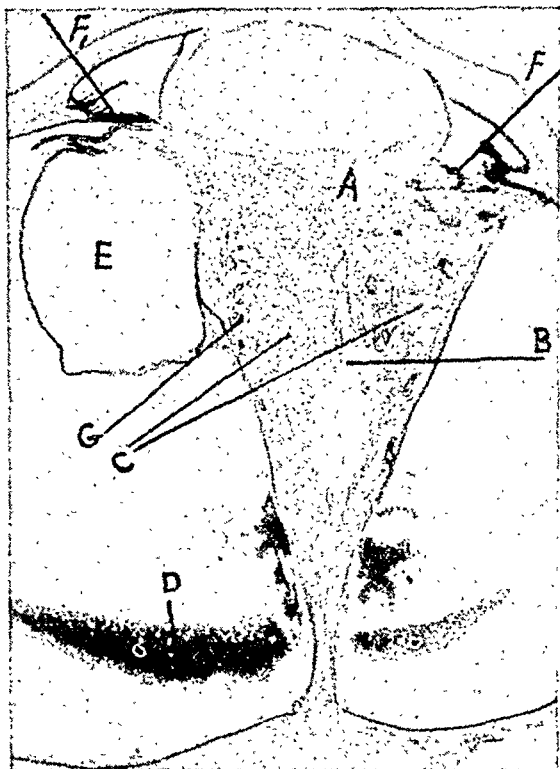
of the retrolental fibrous tissue either on one or both sides of the sections, and in five eyes the retina also. In one eye (figs. 12 and 13) a fibrous strand coursed from the fibrous sheath across the vitreous cavity to the surface of the retina, where traction probably from contracture caused a detachment of the internal limiting layer of the retina (fig. 13, D). In two eyes there was evidence that the membrane had grown; in the one it had extended along the anterior hyaloid membrane for a short distance and in the other it had extended into the lens substance as papillary ingrowths.

B. The lens. The posterior lens capsule was open in seven eyes (figs. 7 and 8). In two eyes in which this was not seen, the capsule was thrown into wrinkles or folds, apparently from the contracture of the fibrous sheath along its posterior surface. This may explain the mechanism by which the capsule is broken. The subcapsular epithelium extended under the posterior capsule in multiple layers in five eyes and in one eye around the region of the broken capsule this epithelium had proliferated. Apparently from the opening in the posterior capsule the cortical area of the lens was cataractous in seven

eyes (fig. 7) and in one eye (fig. 3, C) there was an anterior polar cataract seen as a pyramidal-shaped extension due to proliferation of the subcapsular epithelium. In the cataractous cortical material large lens cells were present in two eyes. Other changes consequent to the opening in the posterior capsule were swelling of the lens and mild inflammatory reaction in the fibrous sheath adjacent to the opening, including some phagocytes containing soft lens matter. The lens in six of the eyes was definitely smaller than normal (fig. 2) and three of these were kidney-shaped, with the concavity directed posteriorly (fig. 3). In four eyes a portion of both the lens and iris were in contact with the posterior surface of the cornea (figs. 7 and 9), causing corneal changes consisting of edema, some infiltration by leucocytes, and early pannus formation. In one of these eyes the lens was dislocated into the anterior chamber and in another a swollen cataractous pyramidal-shaped lens protruded through the pupillary area to the cornea.

C. The retina. In eight of the eyes the retina was in place, appeared to have all of its elements, and no reason could be noted organically why it should not be

Fig. 4 (Reese and Payne). A section of a human eye showing persistence and hyperplasia of the primary vitreous corresponding to clinical type I. The retrolental fibrous tissue at A extends down into the funnel, B, of the detached retina, C. D represents subretinal hemorrhage, and E a retinal cyst. Elongated ciliary processes, F and F₁, extend into the retrolental tissue. The retina is composed of undeveloped embryonic tissue with true rosettes at G and elsewhere. This represents an instance wherein the secondary vitreous has failed to form.



capable of functioning. In one eye the retina although in place was definitely malformed, as evidenced by a deficiency in the nuclear elements, rods, and cones. In five of the aforementioned nine eyes the retina proper extended together with the ciliary processes into the periphery of the retrolental fibrous sheath (figs. 2 and 3). By contracture of the sheath the processes and retina seemed to have been drawn more and more toward the sheath. In only one eye had this process led to a slight detachment of the retina. This was only a small slit separation in the periphery on one side. In most instances the ciliary processes and retina were enmeshed in the sheath only on one side,

which was usually the nasal side. In three of the nine eyes the ora serrata of the retina extended to the base of the iris or to the ciliary processes on one side.

There were five eyes in which the retina was completely detached funnel-fashion, with the retrolental fibrous tissue occu-

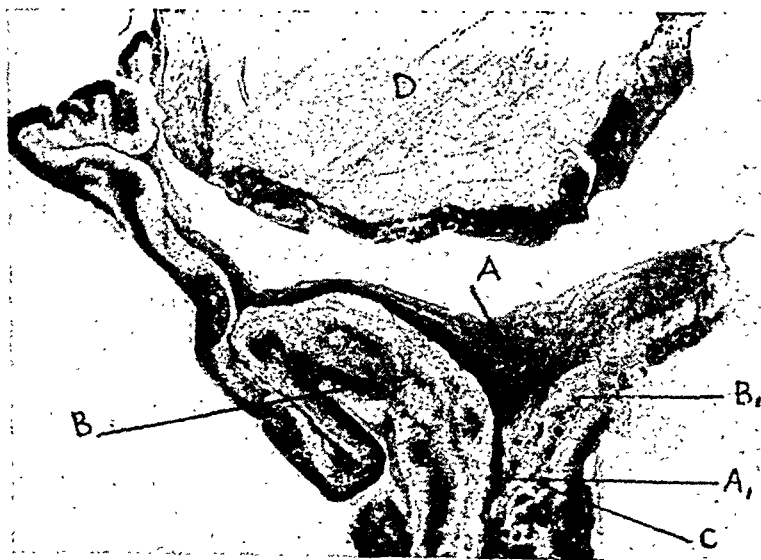


Fig. 5 (Reese and Payne). A section of a human eye showing persistence of the primary vitreous corresponding to clinical type I. This is the left eye of a three-day-old premature girl obtained at autopsy. The persistent primary vitreous, A—A₁, extends down into the funnel of the detached embryonic retina, B—B₁, which contains true rosettes, C. The separation of the lens, D, from the retrolental fibrous tissue is an artefact.

This represents an instance wherein the secondary vitreous has failed to form. The right eye was of normal size and microscopically showed persistence of the primary vitreous, including the hyaloid artery.

pying the base and extending varying distances into the funnel (figs. 4 and 5). These five globes had identical pathologic changes and really constitute a distinct group. They are characterized by embryonic retina as a solid mass of tissue just behind the retrolental fibrous sheath. In this retinal tissue true rosettes were seen in four of the eyes and calcium deposit in three; four of the eyes showed subretinal hemorrhage which was of a massive nature in two; four of the eyes showed malformed and embryonic filtration angle, ciliary body, and iris. One of these cases (fig. 5) was of a 3-day-old premature girl, weighing 2,460 gm., whose eyes were obtained at autopsy. The right eye was of normal size and microscopically showed persistence of the tunica vasculosa lentis and some primary vitreous, persistence of the hyaloid artery, coloboma of the iris, pupillary membrane, retinal folds, and ciliary processes on the posterior surface of the iris. The left eye microscopically showed microphthalmos, persistence of the primary vitreous, embryonic detached retina with rosettes and calcium deposition, coloboma of the iris, pupillary membrane, and ciliary processes on the posterior surface of the iris. The autopsy findings were prematurity, congenital abnormalities of the heart (atrophy and stenosis of the pulmonary artery, hypertrophy of the ductus arteriosus, partial defect of the ventricular septum, right transposition of the aorta, and congenital dilatation and hypertrophy of the right side of the heart), congenital absence of the right hypogastric artery, congenital fracture of the right parietal bone, cranio tabes, congenital emphysema, congenital abnormality of the eyes, papilloma of the tongue, partial cleft palate, acute omphalitis, polydactylism of the right hand and both feet, physiologic jaundice, Meckel's diverticulum, accessory lobe of the spleen, accessory lobe of

the liver, uric-acid infarcts of the kidneys, bicornate uterus, and bilateral club feet.

These five eyes seem to represent instances in which the secondary vitreous failed to form. To summarize, therefore, this is a subgroup characterized by a persistence of the primary vitreous and failure of the secondary vitreous to form, detached embryonic retina, later perhaps subretinal hemorrhage, and frequently glaucoma. It may be that hemorrhage of the primary vitreous with organization and contracture also plays a part.

D. The iris and ciliary body. Some degree of pupillary membrane was noted in six of the eyes. (fig. 3). Both the iris and the ciliary body were rudimentary or underdeveloped in seven eyes and to a lesser degree in several others. As previously stated, the iris along with the lens was in apposition to the posterior surface of the cornea either in part or totally in four eyes. Peripheral synechiae were present in five eyes. The filtration angle was embryonic or underdeveloped in five eyes.

E. Glaucoma. There was histologic evidence of glaucoma in six eyes—peripheral synechiae in five, cupping of the disc in one, and hydrophthalmos in three.

II. TWO EYES FROM ONE CASE OF PERSISTENT PRIMARY VITREOUS INDICATING THE RELATIONSHIP TO HEMANGIOMA

Of twins born three months prematurely, one lived, and no abnormalities were noted except of the eyes. Clinically both eyes showed the following anomalies (fig. 1): the anterior chambers were almost absent and behind each lens there was a vascular, white, saucer-shaped sheath, and long ciliary processes were visible around the periphery. The diagnosis of persistent primary vitreous of each eye was made.

The other twin, who weighed 1 lb. 10 oz. at birth, showed, when several weeks old, an exophthalmos of the right eye. Examination of the interior of this eye showed a detachment of the retina above, with impaired transillumination over the detached area. Examination of the left eye was negative. After many attacks of cyanosis with cessation of respiration, the infant died, and an autopsy was performed.

The autopsy findings were as follows: prematurity; hemangiomas of the pharynx, carotid body on the right side, orbit on the right side, both retinas and adjacent vitreous, and choroidal plexus of the fourth ventricle; exophthalmos on the right side; extramedullary blood formation in the spleen, liver, adrenals, kidneys, and lymph nodes; splenomegaly; jaundice; lobular pneumonia of the right lower lobe; accidental involution of the thymus gland; accessory adrenal gland attached to the fallopian tube; and patent foramen ovale.

Microscopic examination of the eyes showed:

Right eye (fig. 14): The retina is detached over one half of the globe and there is a tear at the ora serrata which may be an artefact. Over the surface of the retina, and particularly of that portion detached, there are many blood vessels without much supporting tissue extending from the nerve head to a point just behind the ora serrata. These vessels and their supporting tissue are attached to the inner surface of the retina. There is some vitreous hemorrhage, which apparently came from the epiretinal vessels. The hemorrhage has become partially organized and the contracture of this, perhaps together with the supporting fibrous tissue of the vascular layer along the retinal surface, has led to detachment of the retina. At no point can excessive blood channels be seen in the fiber layer of the

retina. The filtration angle is embryonic in type.

Behind the globe there is a large non-encapsulated hemangioma (fig. 14, D containing large blood-filled sinuses sur-

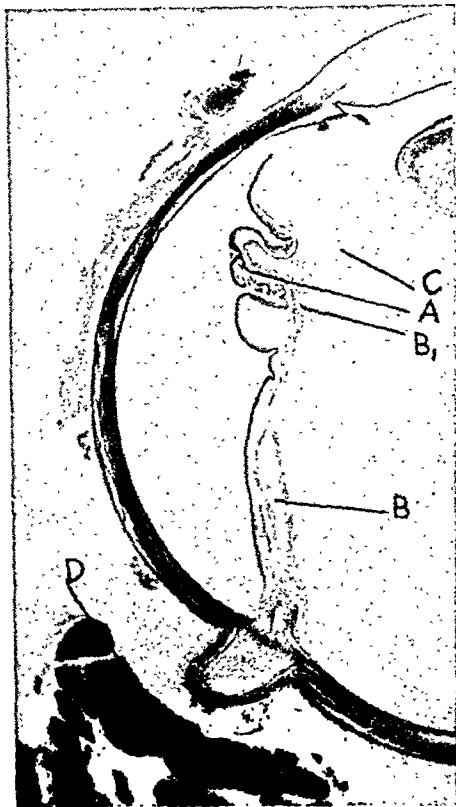


Fig. 14 (Reese and Payne). The section of an eye of a three-month-old premature girl obtained at autopsy. The lesion corresponds to clinical type III. The twin of the patient lived and has typical clinical type-I lesions in each eye (see figure 1). Over the surface of the detached retina, A, is hemangiomatous tissue, B and B₁, in which is some hemorrhage. Contracture has detached the retina and thrown it into folds. A strand of fibrous tissue, C, extends from the hemangiomatous tissue to the posterior surface of the lens. D shows a portion of a typical hemangioma of the orbit which produced proptosis. The fellow eye showed a layer of flat, hemangiomatous tissue along the surface of the retina (see autopsy findings in text).

rounded by hyperplastic endothelial cells.

Left eye: The retina is in position, but along its entire surface there are small blood vessels either as a thin layer or as localized clumps, with relatively little sup-

porting tissue. These same vessels are also seen anterior to the nerve head. In places these vessels over the retina lie along the surface of the internal limiting membrane while elsewhere they appear in the nerve-fiber layer. Some vessels parallel the surface while others course obliquely or perpendicularly to the surface.

The angles are embryonic and the iris stroma appears more vascular than usual. The surface markings of the iris are obscured by a vascular tissue.

Pathologic diagnoses of eyes and adnexa were hemangioma of the right orbit; detachment of the retina of the right eye due to vitreous hemorrhage, organization and contracture from a hemangioma of the primary vitreous and vascular layer of the retina; and hemangioma of the primary vitreous and vascular layer of the retina of the left eye.

III. ONE EYE WITH A PERSISTENT HYALOID ARTERY FROM WHICH A SPONTANEOUS VITREOUS HEMORRHAGE OCCURRED

This is the globe removed from the three-year-old boy described under clinical type IV.

IV. ONE EYE OF A RED SETTER PUPPY SHOWING PERSISTENCE AND HYPERPLASIA OF THE PRIMARY VITREOUS

A white reflex was seen through the pupil and the eye was enucleated with the idea that the lesion might represent a retinoblastoma. Microscopic examination showed the typical lesion representing clinical type I.

ETIOLOGY

It is our belief that the lesion represents the congenital remains or persistence of embryonic tissue and, therefore, is not essentially an acquired one. Sixty percent of our cases occurred in premature in-

fants. We are inclined to believe that the same factor which precipitates early birth may also cause the eye lesions. Infection as the cause of congenital defects is receiving special attention now, due to the accepted connection between maternal rubella during pregnancy and congenital anomalies of the offspring; also toxoplasmosis may occur apparently in a subclinical form in the pregnant woman and produce congenital eye defects as well as choroiditis in the offspring, which may be born prematurely. One of our cases was of a premature boy whose right eye showed persistence and hyperplasia of the primary vitreous (clinical type I). The left eye, which was of normal size, showed an area of juxtapapillary choroiditis not unlike that caused by the toxoplasma.

We do not have convincing evidence indicating that the lesion occurs as the result of maternal infection. We obtained in 12 of the mothers a history of uterine bleeding ranging from the second to the eighth month. The duration varied from a day to several months. Three of the mothers with uterine bleeding also had upper-respiratory infections, with fever, and two mothers without uterine bleeding also had what was thought to be upper-respiratory infection.

TREATMENT

Surgery has been necessary for glaucoma 12 times. Iridencleisis, cyclodialysis, trephining, and iridectomy with sclerectomy have been tried; iridencleisis seems to be the most effective. The iris is usually friable, and a keratome section must be placed accurately because of the shallow anterior chamber. Because accurate examination, including tonometric readings, are not possible without general anesthesia valid results of the glaucoma surgery cannot be given.

On the premise that the retina seems

capable of functioning, judging by the microscopic examination of these eyes, an effort has been made to salvage vision in six eyes of six patients. The object has been to remove the lens substance by repeated discissions and finally to make a vertical cut in the retrolental fibrous tissue with de Wecker's scissors. When the discission is done the lens substance tends not to become opaque, swell, protrude into the anterior chamber, and be absorbed. Very little seems to happen when the lens capsule is opened. The capsule opening, therefore, can be made very extensive without fear of undue swelling. After it was thought that the lens substance had been dissipated for the most part, then a central vertical incision was made through the remaining tissue with de Wecker's scissors. This maneuver was followed by hemorrhage which filled the anterior chamber, but absorption took place in due time. In one instance three discissions and two incisions with de Wecker's scissors were necessary. In 2 of the 6 cases the mother states that the baby can pick up objects and believes this vision comes from the eye that was operated on. These procedures have never left the pupillary area completely clear, and leave much to be desired.

We intend to try irradiation on some of the selected cases as soon as the patients are older.

DISCUSSION

We have deduced from the clinical and pathologic findings that the basic lesion is a persistence in part or *in toto* of the primary vitreous (fig. 16) with or without hyperplasia and with or without secondary changes consequent to hemorrhage, opening of the lens capsule, and glaucoma. As the primary vitreous is mesenchyme it is not surprising that the various tissues into which the mesenchyme can develop are seen in the hyperplastic retrolental

tissue, to wit: fat, cartilage, smooth muscle, blood vessels, and connective tissue. Haden,²⁶ in his description of the embryology of the vitreous, states: "Toward the end of fetal life very little of the primary vitreous remains. Sometimes, however, this primary vitreous fails to absorb and the mesodermal part develops into fibrous connective tissue, and a firm, triangular, opaque mass is formed behind the lens. Ophthalmoscopically, this mass has been diagnosed as glioma of the retina."

There is a tendency for hemorrhage to occur in the persistent primary vitreous, and this may lead to organization, contracture, and their attendant sequelae. There is also frequently an opening in the posterior capsule of the lens, and this leads to cataract with lens swelling and perhaps some inflammatory changes. The corneal changes seen in clinical type II are due primarily to the entrance of aqueous into the stroma, caused by the contact of a portion of the lens and iris with the posterior surface of the cornea but augmented by the presence of glaucoma.

There seems to be evidence to indicate that the formation of the secondary vitreous plays a role in some of the pathologic findings. If fibrous strands of the primary vitreous remain adherent to the inner surface of the retina, then, when the secondary vitreous forms, the retina may be detached. All degrees of this process may be seen, even to the point where the primary vitreous is adherent to the entire inner surface of the retina and the secondary vitreous either fails to form or forms sparingly, with complete detachment of the retina.

There seems to be some relationship of the lesion under discussion to hemangioma. The primary vitreous is, for the most part, angioblastic mesoderm, and in some areas of microscopic sections

studied the retrolental tissue showed highly vascularized areas not unlike hemangiomatous tissue. Most hemangiomas encountered over the body are viewed as having their origin from congenital rests of angioblastic mesoderm. Basically, therefore, the relationship exists, and this is borne out by both our clinical and pathologic findings. We noted hemangiomatous lesions of the skin of the face, scalp, body, or extremities in seven of our cases. We also had a case with the clinical type I lesion associated with microphthalmos on one side and on the other side hydrophthalmos due, we thought, to hemangioma of the choroid together with a hemangioma of the skin of the upper lid. Furthermore, in describing our pathologic material we cited the autopsy findings in an infant with hemangioma of one orbit, both retinas and adjacent vitreous, and elsewhere over the body, whose pre-

mature twin had typical clinical type I lesions of both eyes. The fact that the basic lesion in both the persistence of the primary vitreous and in hemangioma consists of congenital remains of angioblastic mesoderm makes the two conditions fundamentally related.

We wish to express our thanks to Drs. R. Franklin, D. B. Kirby, J. H. Dunnington, C. A. Perera, R. G. Ingalls, R. C. Castroviejo, Olga Sitchevska, R. T. Paton, H. S. McKeown, E. L. Goar, T. H. Johnson, M. Uribe Troncoso, F. Barber, R. B. Thomas, and R. N. Berke for their kindness in allowing us to see their cases and to incorporate them in our work.

We are indebted to Miss Lily Kneiske for her assistance.

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DISCUSSION

DR. IDA MANN (Oxford). I wish first to congratulate Drs. Reese and Payne on this interesting presentation of a very careful piece of work. These cases have been recognized since the middle of the 19th century and a great variety have been described, as it is doubtful whether any two cases are completely identical. The present collection and classification bring out very well the part played in their production by the primary vitreous and also their association with other developmental anomalies. These cases are all good examples of the general principle of the production of developmental anomalies through arrest at a definite stage of intra- or extrauterine life followed by aberrant growth. This aberrant growth may lead to excess normal tissue or, by atypical differentiation of pluripotential cells, to the appearance of tissue abnormal in that situation; for example, cartilage and unstriated muscle in the posterior vascular capsule. That prematurity is often a feature of these cases is not surprising since the interference with development seen in the eye may be part of a general aberration manifesting itself both as prematurity and in various associated malformations (for example, of heart, lungs, palate, and extremities as described by Dr. Reese). The primary cause of the whole clinical

picture is likely to be a maternal upset probably nonspecific in nature but specific in time. That this can happen has been shown by many experimental embryologists, and is now known to occur in man; for example, in rubella cataract and in the maldeveloped retinae of fetuses x-rayed *in utero*. I would therefore like to suggest to Dr. Reese that it would be more helpful if he would consider classifying his cases not on clinical findings alone but into groups based on the probable stage in development at which the initial arrest occurred. Judging the cases from a purely embryologic standpoint I should say his subgroup of type I begins earliest, probably at about the 15-mm. stage and certainly before the end of the organogenetic period. May I also urge in the description of this group the use of the term "failure of coaptation of the retina" in place of "detachment"?

His type III is also early, beginning certainly before the third month and is allied to congenital retinal septum, which can also be explained as a localized linear failure of secondary vitreous.

Type II probably begins between the fifth and sixth months, as there seems to be an accompanying arrest of formation of the angle of the anterior chamber, while those cases of type I which subsequently develop glaucoma arise pos-

sibly only a little later. Type IV is obviously related to an arrest at the very end of fetal life only (during the eighth month).

This classification could be checked and amplified if very accurate data could be obtained of the time of the maternal upset as evidenced by the occurrence of bleeding and of respiratory infections noted in 14 of the mothers. The cases would then probably be seen as a continuous series rather than as sharply differentiated types.

DR. HENRY HADEN (Houston, Texas). Dr. Reese and Dr. Payne are to be congratulated upon this comprehensive study.

I agree with them that the term persistence and hyperplasia of the primary vitreous is appropriate for the congenital abnormalities under discussion. The primary vitreous is composed of mesoderm which flows in between the rim of the optic cup and the lens, the mesoderm that accompanies the hyaloid artery as it passes through the fetal fissure into the optic cup and ectodermal fibers derived from the lens and inner wall of the optic cup.

Toward the end of fetal life the mesodermal part of the vitreous disappears, and the permanent vitreous is exclusively ectodermal in origin. Under certain circumstances a portion of the mesodermal tissue is not absorbed, and a variety of lesions such as Dr. Reese and Dr. Payne have described are the result. The size, position, and style of the lesion are influenced by the fetal age at which the normal recession of the primary vitreous ceased.

I do not see why one should look farther for the nature of these congenital anomalies. A glance at a few sections of the developing vitreous should make this clear.

DR. F. H. VERHOEFF (Boston, Mass.).

I think this is a very interesting and instructive demonstration. In specimens sent me for examination by the Army Medical Museum I have seen all of the conditions described by Dr. Reese. I was particularly interested in his finding of cartilage in the tissue. In the Army Medical Museum a recent specimen, which I had believed to be unique, showed this even better than the one he demonstrated on the screen.

Dr. Reese spoke of hemorrhages occurring in some of these eyes. I should like to ask him if he has ever seen hemorrhage extending from the retrolental tissue into the lens. I have seen this in at least one case.

I think his classification is a most useful one, and in the future will prove of great assistance in the description of such cases. To follow Dr. Mann's suggestion, all he will need to do is to assign certain embryonic periods to the stages he has mentioned.

T. L. TERRY (Boston, Mass.). That Drs. Reese and Payne hold certain views in disagreement with mine is encouraging. What stimulates search for an unknown truth more than theories that are at variance! I am sure that we shall find mutual pleasure and satisfaction in working out an agreement as full understanding of the process is attained.

Their belief that the abnormal development occurs before birth is the most outstanding difference. The evidence is based on one instance in which the infant weighing 3 lbs. 5 oz. was observed on the day of birth to have the disease process well developed. Warkany has proved that the young born of rats in an extreme stage of vitamin-A deficiency develop abnormal eyes early in gestation. We have confirmed his findings. Chief among these abnormalities is the growth of mesodermal tissue in the meshwork of the tunica vasculosa lentis behind the

lens. Although such extreme depletion of vitamin A is not likely in the human, it could cause such a sequence of events. It may account for the lesion on which Reese and Payne base their conclusion of intrauterine development of the process in their most dramatic case.

The process can and does develop during intrauterine life. It has been observed in full-term infants at time of birth. I agree with Reese and Payne that this is probably a process identical with that seen in the premature infants, but I do not believe we have proof yet that they are identical. The frequency of the disease is greater the more premature the infant. The lantern slide shows graphically the increase of frequency of the process the more prematurely the infants are born. The causes of prematurity in infants with and without the ocular malady are not greatly dissimilar, and in many instances the cause is unknown. In some of the instances of spontaneous prematurity the mother had no illness and no known disability before the premature birth. I would expect the ocular defect to manifest itself at birth or very soon thereafter in premature infants nearing term, whereas in the infants weighing three pounds or less, it would not appear for weeks or even months. It is to be regretted that Reese and Payne did not indicate the stage of prematurity of each of their cases.

A routine study of the eyes of premature infants, followed from day of birth to a time when all danger of retrolental-fibroplasia development has passed, has shown me that this disease process can and does become manifest in some premature infants after birth. Dr. Stewart Clifford, who follows closely the premature infants after their incubation, has referred a case to me in which the retrolental tissue was a small opaque spot in the back of the lens resembling a giant

Mittendorf's dot. In one week this opaque area had increased so that it covered perhaps half of the back of the lens, and the anterior chamber was becoming shallow. At the end of the second week the chamber was becoming more shallow. The opaque tissue covered the entire posterior lens surface. I have seen two other such cases. Clifford and I have seen other cases jointly in which the eyes looked normal at birth, but after the patients' discharge from the hospital the opaque retrolental tissue developed and the anterior chamber became obliterated, although we did not see these patients while the fibroplasia was developing. Clifford and I have not been able to determine during their incubation which premature infants will develop retrolental fibroplasia, but Clifford has shown that some 12 percent, or one out of eight, will develop it some weeks or months after birth.

When the true nature of this condition is fully understood, there will be a satisfactory explanation for isolated observations which now seem in conflict. As has been said often, full-term birth is, indeed, only an incident in life, but in extremely premature birth there is a tremendous revolution of physiologic processes. The organs of digestion, respiration, temperature regulation, internal secretion, and even the eyes are called upon to function. An abnormal process can be instituted by this precocious function sufficient to cause such an aberration of ocular development. Why both eyes or the eyes of both twins are not uniformly involved is another puzzling finding in the present state of our ignorance. The view that there is an external exciting cause for this abnormal development and that the most common single factor in many of the individuals who develop it is extremely premature birth produced by a variety of causes, leads to a definite ex-

perimental and investigative approach.

According to Clifford, the only associated defect is the lack of mental development present in some of these infants. The occurrence of angioma I first noted in a patient from Havana, one whom Reese may also have seen. Since then I have found angioma in 16 additional cases. I have not found any statistics showing the frequency of angiomata in infants as a whole, although I am told it is high.

A less important difference in our views is that of terminology. The disease, I believe, represents a growth of embryonic connective tissue in the mesh of the closed tunica vasculosa lentis, which, in part, concurrently or later, reopens before its lumen has become impervious. I say "reopens" because the vessels of the tunica-vasculosa-lentis system had previously been observed when the eyes of extremely premature infants were first examined and had become invisible when they stopped carrying blood. It is not a persistence of the vascular tunic in its embryonic and early fetal state in a region where no such solid tissue is ever encountered during normal development. Thus, I object to the "persistence" used in the title, which the essayists suggest. I consider primary vitreous to be the total mass of mesodermal and ectodermal syncytium between the lens and the retina up to the 40-mm. stage. That blood vessels are a part of it I do not agree, although blood vessels for a time pass through it and perhaps contribute to its early growth. When the blood vessels disappear, I do not visualize the primary vitreous changing over to secondary vitreous, but it persists throughout life as the less viscous material filling the so-called retrolental space and Cloquet's canal. In this view, Prof. Ida Mann told me she was in agreement. If it is correct to consider the hyaloid artery and

tunica vasculosa lentis to be an integral part of primary vitreous, then the name "Hyperplasia of the primary vitreous" loses much of its objection to me. Primary vitreous reaches its full growth at the 40-mm. stage. Were the vitreous a perfect sphere, instead of part of a sphere, its total volume would be less than .420 c.mm. The volume of the adult vitreous approximates 4,300.00 c.mm. If the retrolental fibrous proliferation represents a hyperplasia of the primary vitreous, even though it does not permeate the entire vitreous of these small eyes, it would represent a very great hyperplasia indeed. Exception might be taken to the length of the name suggested by Reese and Payne. Of all the terms formerly used, "fibrovascular sheath" is perhaps the least objectionable, but it does not locate the disease process in any one organ of the body nor in any position in the eye, as does "retrolental fibroplasia."

That a name like "retrolental fibroplasia" is needed is shown by the frequent repetition of some such terms as "retrolental fibrous mass . . . fibrous membrane back of the lens . . . retrolental tissue . . ." occurring sometimes more than once to a page in the essay of Reese and Payne.

Because of the slow manner in which the lens material is absorbed following discussions, probably the result of reduced production and accumulation of aqueous humor in the eye, I have been eradicating the lens by a linear extraction associated with an iridectomy above and an iridectomy below in an attempt to prevent blocking of the pupil. I have used this operation only when the anterior chamber is absent, lenticular-corneal synechiae are present, and central corneal opacities are developing. An injection of normal saline solution into the anterior chamber demonstrated the presence of

these conditions. Careful suturing of the wound permits the retention of injected air in an attempt to prevent recurrence of the anterior synechiae. Following the operation an adequate anterior chamber is usually present.

The suggestion of irradiation to close the blood vessels in the fibroplastic tissue is a sound one which I shall try.

The essay of Reese and Payne indeed contains a great deal with which I fully concur. The quality of their illustrations deserves the highest praise.

DR. REESE (closing). We stated that our classification was purely a clinical one and adopted for convenience sake. I think Dr. Mann's idea to make the classification include the stage at which the maldevelopment in the embryo occurs is well worth while. I agree with her that the term "detachment of the retina" employed with respect to our subgroup of type I might more accurately be replaced by the term "failure of primary coaptation of the retina."

We appreciate very much Dr. Haden's beautiful sections showing the embryology of the primary vitreous and the manner in which it undergoes involution.

Dr. Verhoeff mentioned the relationship to hemangioma. I stated that our conception of a hemangioma is that it represents a congenital rest of angioblastic mesoderm which later begins to grow into a neoplasm. It does not behave like a true neoplasm clinically because angiomas do not have as a rule the capacity for unlimited growth. I tried to point out the fundamental relation of hemangiomas and this lesion and to give what evidence we have that the two may be associated.

We tried to point out what evidence we had of the relationship of the lesion under discussion and infection. We do not believe that this evidence is convincing.

We have never noted hemorrhage extending from the retrolental tissue into the lens as Dr. Verhoeff has.

We believe this lesion is congenital irrespective of whether it occurs in premature or in full-term infants. The matrix of the lesion is present at birth with varying degrees of hyperplasia subsequently. This interpretation is not based solely upon one case as stated by Dr. Terry but upon several factors. First, in premature infants the lesion was observed at birth in one case and at less than one week of age in one case; in full-term infants the lesion was noted at birth in three cases and at less than one week of age in four cases. The clinical and pathologic features appear identical in both groups. Second, the hyaloid artery, if absent at birth, never develops later; rather, if it is observed later it was necessarily present at birth. In other words, the hyaloid artery is always a congenital manifestation. The hyaloid artery is frequently associated with the condition under discussion. Third, the various tissues (connective tissue, blood vessels, fat, cartilage, and smooth muscle) seen in these lesions take origin from mesoderm. Mesoderm does not form after birth.

Dr. Terry disagrees somewhat with our conception of the primary vitreous. It seems to me our views in this regard are the ones generally advanced by the embryologists. Irrespective of names there certainly occurs in embryonic life an angioblastic mesoderm inside the eye and normally this disappears. When it persists and becomes hyperplastic we believe it gives rise to the various lesions described in this general group.

Dr. Terry refers to a case in which he observed an increase in an island of retrolental tissue resembling a giant Mittendorf dot. One of our cases (fig. 10) was perhaps similar when first observed a few days after birth. After four

years our case showed no increase in size, and the blood vessels disappeared.

Dr. Terry's case in which he observed the development of this lesion from birth is difficult to explain on the basis of our conception of the lesion. I imagine it can be explained on the ground that there was a small area of that retrolental tissue present and this showed an unusual degree of rapid hyperplasia.

If anyone plans to study this basic lesion experimentally we think the dog might be a good medium. We base this on the fact that we have seen a typical type-I lesion in a red-setter puppy. This puppy had a white reflex in the pupil, and because of the possibility of retinoblastoma an enucleation was done. Sections showed typical retrolental fibrous tissue with a hyaloid artery.

GRADUATE TRAINING IN OPHTHALMOLOGY*

SECOND JACKSON MEMORIAL LECTURE

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It would seem most fitting and proper that the subject of a Jackson Memorial Lecture should pertain to the question of ophthalmic education, a topic most dear to the heart of Dr. Edward Jackson. He himself lived through the era of the development of modern training, for in his early days organized teaching was non-existent in the United States. He saw the vicissitudes and struggles of the early aspirant for ophthalmic training, and he saw the gradual emergence of ordered American ophthalmology from the chaos of the last century.

Before the turn of the century there was no formalized training in ophthalmology in the United States. True it is that many a good ophthalmologist was developed during those days, but it was by preceptorship, in the more or less haphazard clinics of that day, or in private offices, supplemented by personal non-supervised reading. The amount of training that a man could obtain depended upon his personal energy and ambition.

The more fortunate journeyed to Europe, to the clinics of Vienna, Berlin, Paris, and London. In many instances they were lucky enough to obtain volunteer assistantships for one or more years, but in the majority of cases they merely observed the work as it was performed by the regular personnel of the clinic. These clinics were fairly well organized, and the native men obtained their training in ophthalmology by serving as assistants for 5 to 10 years. But still there was no formalized course of training in ophthalmology, here or elsewhere.

The foreign study and the influence of the foreign clinics became manifest here about 1900. In many of the large cities ophthalmic clinics had been in operation for 30 or even 40 years, but they were not well organized, and the majority required assistantships or internships in both eye and ear, nose and throat. In fact, in practically all of the universities those chairs were combined, as they were in the clinics. But the spirit of ophthalmology was becoming apparent in the rank and file, and that spirit demanded adequate didactic and clinical facilities for its expression. Nor could that spirit be denied, and during the next 15 years the develop-

* This lecture was to have been read before the 1945 meeting of the American Academy of Ophthalmology and Otolaryngology, which was cancelled on account of the National Emergency.

ment of ophthalmic clinics and ophthalmic residencies progressed with startling rapidity. Ophthalmology became divorced from otolaryngology and succeeded in freeing itself from the dominating influence of its big brother, general surgery, so that the chair of ophthalmology in the medical schools became a separate entity. But still there was no formalized training in ophthalmology.

Then came the advent of the American Board of Ophthalmology, formed jointly by the three national societies, for the purpose of introducing standards into the training and practice of the specialty. Some years elapsed before the Board realized its importance, and formulated its aims, but almost overnight its educational influence became manifest. The requirements set up tentatively by the Board gave the ophthalmologic candidates a definite idea as to the course of study it was necessary to pursue; an idea that in the past had been a mere will-o-the-wisp. They perceived the goal of a completely rounded ophthalmologic education, and although formalized and supervised training was still lacking, they were able by industrious reading to form a fairly solid foundation upon which to build clinical training.

Gradually, formalized training began to make its appearance here and there. In one clinic, a course of lectures would be given upon basic subjects, while in another the clinical aspects were treated didactically as well as practically. A postgraduate school developed a course of training in ophthalmology in which didactic and laboratory work was given simultaneously with some clinical training. And so under the influence of the Board the progress has been continuous, and throughout the country more and more opportunities are being developed for serious training in ophthalmology—training that will fit a man to become a safe and sound special-

ist, upon whom his people and his colleagues can rely.

Still the opportunities for formalized training in ophthalmology are below the nation's requirements. It has been estimated that a minimum of 200 ophthalmologists a year are required to maintain the present quota; but it is also agreed that the current number of qualified ophthalmologists, certificated or otherwise, is far below the number required by the population of the United States. At present the opportunities for thorough training in ophthalmology, basic, didactic, and clinical, number about one quarter of the requirements. Another half obtain training through clinical residencies, but without basic or didactic instruction. The remainder pick up what they can.

To the American Board of Ophthalmology is due unstinted praise for its efforts and accomplishments. But the Board is ever-changing, and although universally recognized, it has no authoritative standing or academic backing. So it would seem that the time has come to incorporate the achievements and work of the Board into such form as to insure perpetuity for the ideals and accomplishments that have done so much to advance ophthalmology in this country. Such solidarity can be attained only through academic connections, and to that end it would seem fitting and proper that the gap that exists between requirements for graduation from the medical school and the certification by the American Board of Ophthalmology be filled by the university. Upon the university should fall the responsibility for formalized training in ophthalmology for a sufficient number to fill the needs of the country.

In general, formalized education in the universities is held at two main levels, the undergraduate school culminating in a Bachelor's degree and the graduate school culminating in a Doctor's degree. Above

that level the universities offer training only on a research or a personalized basis.

During the past 25 years the need has arisen for a third level of university training, particularly as it pertains to medicine and the medical specialties. This level should cover the period between completion of the general internship and the completion of training required by the specialty boards. That period of training, which, in the majority of cases, is now more or less haphazard, is definitely a function of the universities, and when assumed by them will take on a systematized character more or less standardized, as is the present work in the undergraduate medical schools.

The gap that exists between the completion of the year of internship and the attainment of the certificate of the Board is at present the major deficit in ophthalmic education, and there is no uniformity in the endeavors of the various institutions to fill that gap. One offers a one-year clinical residency without didactic training in any of the basic sciences; another considers a two-year clinical residency with a minimum of basic-science training sufficient; while at the other end, is the five-year residency with complete and adequate basic training. Because of the chaos that exists under the present system, or lack of system, it is very evident that the gap should be filled under university jurisdiction and that a certain degree of uniformity in ophthalmic training on a nationwide basis should be introduced. Regimentation should, of course, be avoided, but a formalized curriculum could serve as a basis for training which would be varied in the universities and their associated institutions according to existent facilities.

Let us see how such a plan might function in our own specialty of ophthalmology, a specialty which is probably best prepared to institute a regular uni-

versity program of graduate teaching.

It must not be forgotten that there are two classes of men who demand training in ophthalmology: those who intend to pursue an academic career of investigation or teaching, and those who intend to devote themselves to the clinical practice of ophthalmology. The first group is small in number and can be handled adequately by each institution as the case arises, and consequently requires but scant attention here. The second group outnumbers the former by a hundred to one, and hence requires more intensive study and more extensive facilities. To that group are dedicated the following pages.

Before acceptance of a student into the training realms of ophthalmology, rather extensive psychologic and psychometric tests are in order, to prove the fitness of the candidate for the specialty. Included should be tests for manual dexterity, the *sine qua non* of an ophthalmic surgeon. Good vision, normal color perception, and perfect stereopsis are even more essential to the art of eye surgery than they are to the piloting of an airplane.

Upon completion of the general interne year, a period of instruction in the basic sciences so requisite to a well-grounded ophthalmologist, should follow. It should be given within the university walls and be operated as a regular class of the medical school. The length of time would, of course, vary with different institutions, but in no case should it be less than three months nor more than six. The course should be an elaboration into detail of the basic sciences of ophthalmology as taught to the undergraduate medical student, and to that end would require a mixed faculty. The general aspects of anatomy, physiology, optics, chemistry, and bacteriology should be presented by the undergraduate teachers of those subjects in the undergraduate laboratories, whereas the application of those subjects

in the realm of ophthalmology should be presented by clinical ophthalmologists who have devoted special attention to those sciences. Lectures should play but a small role in such instruction, and the major pedagogic methods should be those of laboratory demonstrations and directed conferences and quizzes. The study of pathologic anatomy should be instituted toward the end of such a basic course, for there should be no contemplation of clinical ophthalmology until after conclusion of the basic course.

The candidates are then ready to enter the period of clinical training, which should be not less than two years. Obviously, the university hospitals cannot accommodate the total number, and extramural expansion is necessary. That can be accomplished by bringing into the fold such nearby general hospitals as offer an adequate residency in clinical ophthalmology, and supplementing that clinical work with university instruction. For example, there are in Chicago six large general hospitals that have clinical residencies in ophthalmology of one year each, one man at a time. These should take two residents for two years each, staggered so as to provide a senior and a junior, who have gone through the basic course at the university. The university hospitals in Chicago can take eight residents per year, with the result that each basic course would have 20 candidates.

Whether the resident were serving in the university or in an affiliated hospital, the instruction should be the same, and should be given in the early evening after the clinical work for the day is finished. At least once, and preferably twice, a week the group should assemble at the university for clinical or pathologic conferences or seminars. For such conferences, held under the direction of experienced clinical teachers, a two-year program should be prepared in advance, and

the junior group and the senior group should be kept separate; otherwise one year would be merely a repetition of the preceding. At each conference the prescribed reading for the next conference should be given, and thus each resident could prepare himself in advance. The conferences and seminars should embrace the clinical aspects of ophthalmology from beginning to end, borderline topics, the relationship of ophthalmology to other medical specialties, and social and preventive ophthalmology. Pathologic conferences should be held at least once a week under the ophthalmic pathologist, and each resident should be given prepared sections and clinical histories of cases, upon which he should present a prepared report at later conferences. Those studies should continue uninterruptedly throughout the entire two years of clinical residency.

Upon conclusion of the two years' clinical residency with its associated factors, a comprehensive oral and clinical examination should be given the residents by the combined staffs of the university and affiliated hospitals; including demonstrations of surgical ability upon animals and patients. Successful completion of such examination should entitle the resident to a higher degree, possibly Doctor of Science in Ophthalmology, and the automatic award of the certificate of the American Board of Ophthalmology, whose examinations would then be confined to men whose training had been other than the prescribed university course.

Now let us see what this would do for the training program on a nationwide basis. As of December, 1941, there were opportunities for approximately 180 men to be trained each year in ophthalmology, of whom about one third received adequate basic and didactic instruction, the remainder receiving clinical training only.

Under the proposed plan, at least 35 of the Class A medical schools could and probably would participate, taking in a class of 10 to 20 men each year. That would mean 400 to 700 men adequately trained in ophthalmology each year, as contrasted with the figure just quoted. Of the 3,500 or more approved hospitals in the United States, sufficient clinical residencies in ophthalmology can be developed to take care of the extramural aspects of the program.

Approval of this plan by the American Board of Ophthalmology and by the various teaching institutions could lead to an early establishment of this or some simi-

lar system. The University of Illinois has authorized the Department of Ophthalmology to set this plan into operation as soon as the teaching members of the ophthalmic staff are released from military service and full ophthalmic residencies are again functioning. Thus it becomes very possible that within the course of a few years, there may be attained the adequate formalized training in ophthalmology of numbers sufficient to supply the needs of the country, fulfilling the hopes of our great teacher, the late Edward Jackson.

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REPORT FROM THE WILMER INSTITUTE ON THE RESULTS OBTAINED IN THE TREATMENT OF MYOPIA BY VISUAL TRAINING*

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The purpose of this paper is to report the results of an investigation on the effect of visual training in uncomplicated myopia. The participation of the Wilmer Institute in this investigation was limited solely to examination of the patients before the beginning of the training, and again after the training had been completed. The pre- and posttraining examinations were made in the Wilmer Institute by staff members under the direction of Dr. Frank B. Walsh. The training program itself was conducted in another part of Baltimore, remote from the Johns Hopkins Hospital, under the direction of Dr. A. M. Skeffington, Director of the Graduate Clinic Foundation of Saint Louis, Missouri, and his associates. The Wilmer Institute therefore acted solely as a judge of the effect obtained, and so

acted without either endorsement or condemnation of the visual training conducted by Dr. Skeffington and his associates. The background leading up to this investigation was as follows:

In the spring of 1944, the Curtis Publishing Company, through the agency of Mr. Bruce Gould, offered to finance an investigation on the merits of widely publicized methods of visual training in the treatment of myopia. The fundamental idea of this investigation was to collect a suitable group of patients with uncomplicated myopia, have their visual acuity and refraction errors determined prior to the course of visual training, and at the conclusion of such training have the patients examined to determine if any demonstrable improvement in the vision or underlying myopia had occurred. To this end Mr. Gould proposed to bring to Baltimore several leading advocates and exponents of the training therapy, which

* From the Wilmer Ophthalmological Institute of the Johns Hopkins Hospital and University.

gentlemen would establish a clinic in Baltimore where such treatment could be properly pursued. The Wilmer Institute was requested to act as judge of the results obtained. After preliminary discussion, the Wilmer Institute accepted this proposition under the following specific conditions:

The candidates for training would be recruited by Dr. Skeffington and his associates, and sent to the Wilmer Institute for a preliminary examination. After this examination candidates showing any ocular pathologic change or who did not appear suitable for such treatment would be rejected by the examining physician in the Wilmer Institute. The nature of the eye examination to determine the visual acuity, refractive error, and the like, was entirely at the discretion of the staff of the Wilmer Institute, with the agreed stipulation that recognized standard tests and standard illumination would be employed. The results of the preliminary examinations were not to be transmitted to Dr. Skeffington or his associates, but were to be filed with the Curtis Publishing Company. The selected patients would then be given such visual training as Dr. Skeffington and his group believed proper, the staff of the Wilmer Institute having no knowledge of the type or extent of such training. On the completion of the course of visual training, the patients would be returned to the Wilmer Institute for a second examination. In certain cases, notably when some improvement was noted, the patients might again be returned to the Wilmer Institute for a third examination to determine whether the observed improvement was maintained. It was agreed that the results of these examinations should be tabulated and reported by the Director of the Wilmer Institute in a recognized medical periodical before they were reported or referred to either by the Curtis Publishing Com-

pany or Dr. Skeffington's group. The Wilmer Institute received no financial support of any kind from the Curtis Publishing Company or any other agency. These conditions were agreed to by the Curtis Publishing Company, by Dr. Skeffington's group, were approved by several leading ophthalmologists who were consulted, and the investigation was undertaken.

Accordingly, in September of 1944, Dr. Skeffington and his associates moved to Baltimore and established a clinic in the downtown section of the city. The patients for examination were recruited chiefly from the public schools of Baltimore, with the inclusion of a few private patients and nine candidates who were midshipmen from the United States Naval Academy in Annapolis. These patients were then sent to the Wilmer Institute for examination, and 103 were selected as having uncomplicated myopia and being proper candidates for training. The patients were then returned to Dr. Skeffington for training. On the completion of the training they were then returned to the Wilmer Institute for the posttraining examination. The training clinic continued in operation until December of 1944. The final, third examinations on the patients showing improvement were completed in May of 1945.

TECHNIQUE OF EYE EXAMINATION

First examination. Each patient referred to the Wilmer Institute as a candidate for training under this program was subjected to the following examinations.

1. Determination of the visual acuity without correction of each eye at 20 feet or a shorter distance when necessary. Four charts were used for this purpose: (a) Snellen chart with letters, (b) Snellen chart with numbers, (c) Landolt broken-ring chart, and (d) Snellen letter-E chart. In this examination, as in all tests of

visual acuity, the individual was required to declare that smaller objects could not be seen, or must consistently make comparable errors in stating what was seen. The amount of illumination was between 24 and 26 foot candles, and this was constantly checked.

2. A cycloplegic was then instilled in the eyes. Two instillations of 5-percent homatropine were used in individuals nine years or over. Atropine sulfate, 1 percent solution three times a day for two days, was used in younger individuals. The eyes were then retinoscoped and the static refraction was determined.

3. A general external and ophthalmoscopic examination was made to rule out any ocular pathologic process.

Second examination. The visual acuity without correction was again made on the four separate charts as in the first examination. In 67 instances further retinoscopic determination was made.

Third examination. The visual acuity without correction was determined as in the first two examinations.

TECHNIQUE OF VISUAL-TRAINING PROGRAM

The visual-training program which these patients received is summarized by Dr. Skeffington as follows:

"The visual training rests on the postulate that seeing is a learned act and is therefore susceptible to training. A system of differential analysis was employed to discover the type of distorted pattern resulting from undesirable visual practices. Spheres, cylinders, prisms, and targets were employed in this training program with the idea of reorganizing the visual behavior patterns that the visual skills, including acuity, can be improved significantly. This method of visual training has neither in theory nor practice any relation to the so-called Bates theory, and in theory and practice it involves no deviation from the known and accepted theories

and facts of physiology and neurology of the eye or the experimental psychology of vision. It has its inception in the work of optometrists, stemming from the standard literature on learning. The records of this development from its start exist in the optometric literature, and are covered in the papers of Drs. George Crow and Harry Fuog, S. K. Lesser, Leslie B. Burdette, Marguerita Thoma Eberl and others, in the Optometric Extension Program, articles on training in the files of the Optometric Weekly, the American Journal of Optometry, and other publications."

TABULATION OF RESULTS

The full information on every patient is contained in the final table IX. It will be noted that there were marked fluctuations in the visual acuity of the majority of the patients on different charts. It was impossible to average these different visual acuities on the Snellen scale. Therefore, each observation on the Snellen scale was reduced to percentage visual acuity, using the tables computed in Dr. A. C. Snell's book on "Medico-legal ophthalmology." The pre- and posttraining visual acuity was arrived at by taking an average of the percentage visual acuity as determined on the four charts. The results reported, whether they be improvement or diminution of vision after training, are therefore an increase or decrease in the percentage visual acuity, and not the percentage of gain or loss of vision.

From the statistical viewpoint, this method of reporting results leaves much to be desired. Primarily, as will be hereafter pointed out, it weights the scales in favor of improvement according to the degree of myopia. Secondly, grouping the patients according to the results involves the fallacy that each group contains individuals with all degrees of myopia. However, attempts to group the patients according to the degree of myopia

TABLE I.*
Patients Showing Improvement In All 4 Charts.

Cases	Average Percentage Visual Acuity				Average Percentage Improvement on 2nd Exam.	
	Before Exercises		After Exercises		Right	Left
	Right	Left	Right	Left		
1	13	9	37	51	24	42
3	83	69	94	92	11	23
4	79	95	99	100	20	5
13	88	61	98	88	10	27
14	24	17	46	51	22	34
16	81	81	91	90	10	9
17	3	20	20	84	17	64
30	13	15	41	36	28	21
34	9	10	34	39	25	29
37	5	3	37	37	32	34
40	1	1	16	21	15	20
44	9	12	21	42	12	30
52	1	3	14	33	13	30
53	8	2	49	48	41	46
57	32	4	72	70	40	66
63	42	47	79	66	37	19
67	2	4	10	13	8	9
78	6	7	47	26	41	19
89	17	16	71	71	54	55
95	17	23	71	60	54	37
97	42	43	81	87	39	44
98	88	4	97	28	9	24
103	2	6	43	34	41	28
104	100	11	100	44	0	33
106	17	14	35	39	18	25
107	19	27	46	53	27	26
121	2	3	11	10	9	7
122	2	1	19	9	17	8
124	40	42	73	76	33	34
126	48	39	83	71	35	32
Average.....	29.76	22.97	54.5	52.3	24.7	29.3

resulted in a multiplicity of small tables which were meaningless. Further, since some patients had high degrees of anisometropia, the patient as an entity could not be grouped under one heading. The attempt to group the material under "eyes" rather than patients, completely ignored the individual subjective element. Although the patients in each of the four

groups varied somewhat in the degree of their myopia, nevertheless, as will later be pointed out, the average percentage visual acuity of groups I and II was low, of group III was in the mid-zone, and of group IV was high. Therefore, despite the fact that grouping the patients on the basis of results rather than degree of myopia involves a statistical fallacy,

* The tables for this article were set up and provided for our use by the Transactions of the American Academy of Ophthalmology and Otolaryngology.

nevertheless the different groups roughly reflect different average levels of myopia, and this method appears to be the fairest and best calculated to give an accurate over-all picture.

RESULTS

On the basis of the average pre- and posttraining percentage visual acuity, the

acuity, or patients who showed an improvement in one eye and a loss of visual acuity in the second eye, irrespective of the degree.

IV. Patients who showed a loss of 10 points or more in the percentage visual acuity of one eye, while the second eye was either stationary or likewise showed some loss in percentage visual acuity.

TABLE II.
Results of Third Test Three Months After Completion of Exercises.
Patients Showing Improvement In All 4 Charts.

Cases	Improvement of Percentage Visual Acuity on 2nd Test		Final Improvement of Percentage Visual Acuity on Third Test	
	Right	Left	Right	Left
1	24	42	30	34
34	25	29	7	— 2
30	28	21	16	15
37	32	34	21	31
52	13	30	2	2
57	40	66	16	4
63	37	19	19	18
97	39	44	27	20
107	27	26	31	35
Average.....	29.4	34.5	19.8	17.4

patients fall into four definite groups. These are:

I. Patients who showed a consistent improvement in each eye on all four charts.

II. Patients who did not show a consistent improvement on all four charts, yet in whom the over-all average in the percentage visual acuity after training was at least 10 points better in one eye than the pretraining figure, and in whom the second eye was at least no worse, irrespective of the fact that on one or more charts the posttraining vision was not improved, or might even be below the pretraining level.

III. Patients who showed no practical change in the eyes after training. This includes patients in whom the observed increase or decrease in vision was less than 10 points in the percentage visual

GROUP I

There were 30 of the 103 patients who showed a consistent improvement in each eye, on all four charts, of over 10 points in percentage visual acuity. The average results of these 30 patients are shown in table I.

Thus, the average improvement in percentage visual acuity in the right and left eyes was, respectively, about 24.7 and 29.3 points. This corresponds to an average improvement of reading about one to three additional lines on the Snellen charts, depending on the degree of myopia, a patient with high myopia, having a pre-exercise acuity of 20/200 and a post-exercise acuity of 20/100, showing 28 points of improvement, whereas one with low myopia, having 20/50 pre-exercise acuity and 20/20 posttraining acuity, showed only 22 points of improvement,

TABLE III.
Patients Showing Inconsistent Improvement on Four Charts.

Cases	Average Percentage Visual Acuity				Average Improvement in Percentage Visual Acuity	
	Before Exercises		After Exercises		Right	Left
	Right	Left	Right	Left		
5	100	27	99	52	-1	25
9	16	18	27	47	11	29
12	27	16	42	27	15	12
20	68	70	82	84	14	14
27	16	24	21	41	5	17
28	88	22	90	59	2	27
29	2	4	4	26	2	22
32	27	15	32	27	5	12
35	17	11	20	31	7	20
38	2	1	19	16	17	16
39	4	5	10	15	6	10
41	21	31	68	32	47	1
42	21	14	21	28	+ -	14
46	7	18	18	18	11	+ -
48	4	4	10	22	6	18
49	4	2	6	26	4	24
50	16	16	34	21	18	5
51	8	3	8	17	+ -	14
60	49	17	62	50	13	37
65	18	19	27	32	9	13
66	21	23	39	46	18	23
68	14	17	33	30	19	13
70	35	35	52	55	17	20
74	22	26	31	47	9	21
79	42	56	77	57	25	1
88	8	17	15	35	7	18
94	12	28	54	56	42	28
96	57	44	67	72	10	28
109	3	98	21	98	18	+ -
110	15	11	27	17	12	6
127	24	34	55	49	31	15
Average.....	24.8	23.4	37.8	39.8	13.0	16.4

despite the more spectacular improvement on the Snellen scale.

A consistent effort was made to have each of these 30 patients return for a third examination to determine to what extent the improvement observed on the second examination had been maintained. These efforts were successful in only nine instances. The remaining 21 patients

had either disappeared or had lost interest and did not respond to the request to return. A comparison of the gain over the pretraining level showed by these nine patients is set forth in table II.

In these nine patients the average gain in percentage visual acuity disclosed on the second examination in the right and left eyes was, respectively 29.4 and 34.5

points. On the third examination, performed from three to five months after the second examination, this had dropped to 19.8 points in the right eye and 17.4 points in the left eye. In two patients (1 and 107) the improvement noted on the second examination had, on the average, been maintained. In the remaining seven, the observed improvement had declined.

GROUP II

There were 31 patients who, while they showed no consistent improvement on all

patient (60) had lost two thirds of the observed improvement. One patient (127) had lost two thirds of the improvement noted in the right eye, and all the improvement in the left eye. The remaining three patients (41, 79, and 110) had lost all of the improvement observed in both eyes, the final figures being actually below the pretraining level although the diminution was in no case significant. The final average gain of these eight patients was six points in the right eye and 1.9 points in the left eye. In short, the average percentage visual acuity was essentially unchanged.

TABLE IV.
Results of Third Test Three Months After Completion of Exercises In Patients Showing Inconsistent Improvement On Four Charts.

Cases	Improvement of Percentage Visual Acuity In 2nd Test		Final Improvement of Percentage Visual Acuity On Third Test	
	Right	Left	Right	Left
9	11	29	19	10
20	14	14	16	11
41	47	1	— 5	— 7
60	13	33	4	10
70	17	20	22	20
79	35	1	—16	—22
110	12	6	— 2	— 5
127	31	15	+10	— 2
Average.....	22.5	14.9	+ 6	+ 1.9

four charts, nevertheless showed an overall average improvement of at least 10 points in one eye, and no loss in the second eye. The average records of these patients are set forth in table III.

The average improvement of percentage visual acuity of these 31 patients was 13.0 points in the right eye and 16.4 points in the left eye. Eight of these patients returned for a third examination, three to five months after the completion of the training. A comparison of the gain disclosed in the second examination against the final change shown in the third examination is shown in table IV.

Three patients (9, 20, and 70) had roughly maintained the improvement observed on the second examination. One

GROUP III

There were 32 patients in this group who showed only minor change in the visual acuity after visual training. The changes noted were: (a) either less than 10 points in the percentage visual acuity either on the plus or minus side in each eye, or (b) a variation of greater than 10 points plus in one eye while the second eye showed a loss in percentage visual acuity. The average swing in these 32 patients was +4.1 points in the right eye and +2.4 points in the left eye. No attempt was made to bring these patients back for a third examination. The average figures for these 32 patients are shown in table V.

TABLE V.
Patients Showing No Significant Change In Percentage Visual Acuity After Exercises.

Cases	Average Percentage Visual Acuity				Average Change In Visual Acuity	
	Before Exercises		After Exercises		Right	Left
	Right	Left	Right	Left		
2	95	98	98	99	+3	+1
6	77	79	77	79	+—	+—
7	78	82	73	84	—5	+2
8	46	61	51	69	+5	+8
10	18	42	22	43	+4	+1
15	30	20	25	30	—5	+10
23	14	61	21	53	+7	—8
33	51	68	42	80	—9	+12
36	38	32	37	43	—1	+11
54	62	69	62	74	+—	+5
55	86	81	85	76	—1	—5
58	50	87	66	83	+16	—4
59	9	13	14	20	+5	+7
64	3	2	4	9	+1	+7
69	22	24	29	24	+7	+—
71	9	6	18	11	+9	+5
72	27	21	22	23	—5	+2
75	2	1	11	4	+9	+3
81	62	54	69	51	+7	—3
85	23	39	22	39	—1	+—
86	1	2	3	4	+2	+2
87	2	3	5	12	+3	+9
90	9	23	6	41	—3	+18
91	10	16	36	11	+26	—5
93	16	10	16	13	+—	+3
99	79	80	88	87	+9	+7
100	86	89	85	89	—1	+—
101	20	12	24	15	+4	+3
105	34	71	67	52	+33	—19
111	100	25	100	26	+—	+1
112	21	56	28	52	+7	—4
131	20	23	26	32	+6	+9
Average.....	37.5	42.2	41.6	44.6	+4.1	+2.4

GROUP IV

There were 10 patients who showed a diminution in the percentage visual acuity in both eyes after visual training. As already stated, these changes on the minus side were insignificant, and well within the subjective margin of error. The changes averaged -12.7 points in per-

centage visual acuity in the right eye, and -8.9 points in the left eye. The average figures for these 10 patients are given in table VI.

A summary of these four groups is shown in table VII.

A number of these 103 patients, 67 in all, were again retinoscoped under a

TABLE VI.
Patients Showing Slightly Diminished Percentage Visual Acuity After Exercises.

Cases	Average Percentage Visual Acuity				Average Loss In Visual Acuity	
	Before Exercises		After Exercises		Right	Left
	Right	Left	Right	Left		
18	92	17	85	7	-7	-10
22	97	90	96	76	-1	-14
31	65	81	60	69	-5	-12
45	79	68	69	68	-10	+—
56	..	26	..	14	..	-12
76	85	77	76	77	-9	+—
77	83	78	66	74	-17	-4
83	70	44	20	40	-50	-4
84	88	96	79	79	-9	-17
108	95	91	89	75	-6	-16
Average.....	83.7	66.8	71.0	57.9	-12.7	-8.9

cycloplegic on the second examination after completion of the eye exercises. A comparison of the pre- and postexercise retinoscopies is shown in table VIII. It is immediately apparent that the visual training had produced no change in the basic myopic error. The occasional minor changes noted are those which would result in variations of the action of the cycloplegic.

COMMENT

It is not within the scope of this report to discuss any theoretical merits or demerits in the visual-training program detailed in the optometric literature and used on these patients, or to comment upon other popular theories which have at one time or another been advanced in support of the treatment of myopia by eye exercises or visual training. While

we did determine the retinoscopic error in a number of the patients before and after the visual training to ascertain if any change had occurred in the basic refraction, and we likewise followed with interest changes in the psychologic reaction of the trainees toward their visual handicap, nevertheless our chief objective in this experiment was to determine if the visual training produced any significant alteration in the visual acuity of the trainees. The complete data from which conclusions on the latter point are drawn are given in table IX. Comment here is limited to statistical criticism of these data, and to observations on the reaction of the patients to the visual training.

Primarily, this study is *per se* uncontrolled. A proper control would be a

TABLE VII.
Summary of Results.

Status of Patient	No. and Percentage of Total Group	Average Net Change In Percentage Visual Acuity	
		Right	Left
Improvements on all four Charts.....	30 or 29.1%	24.7	29.3
Inconsistent Improvement.....	31 or 30.1%	13.0	16.4
No Essential Change.....	32 or 31.1%	+4.1	+2.4
Slightly Diminished Visual Acuity.....	10 or 9.7%	-12.7	-8.9

TABLE VIII.
Retinoscopic Findings Before and After "Visual Training."

	Before Visual Training	After Visual Training
Case 2.....	R. — 0.75 = + 0.25 × 90 L. — 0.25 = — 0.37 × 180	R. — 0.75 L. — 0.50 = + 0.25 × 50
Case 10.....	R. — 2.50 L. — 2.25	R. — 2.25 L. — 2.00
Case 12.....	R. — 2.50 = — 0.50 × 90 L. — 2.50	R. — 3.50 L. — 3.00 = — 0.50 × 180
Case 14.....	R. — 1.75 L. — 1.62	R. — 2.00 L. — 1.75
Case 15.....	R. — 2.75 L. — 3.75 = — 0.50 × 120	R. — 3.37 L. — 4.00 = — 0.62 × 180
Case 16.....	R. — 1.00 L. — 1.00	R. — 1.50 L. — 1.00
Case 17.....	R. — 4.25 L. — 3.00	R. — 4.00 L. — 2.50 = — 0.50 × 180
Case 18.....	R. — 0.75 = — 0.37 × 90 L. — 5.50	R. — 0.75 = — 0.50 × 90 L. — 5.50
Case 20.....	R. — 0.75 L. — 1.00	R. — 0.25 = — 0.50 × 20 L. — 0.25 = — 0.25 × 140
Case 22.....	R. — 0.25 × 180 L. — 0.75 = + 0.25 × 90	R. + 0.25 × 90 L. — 0.75
Case 23.....	R. — 2.00 = — 0.50 × 10 L. — 1.50	R. — 2.25 = — 0.25 × 180 L. — 1.50
Case 28.....	R. — 0.62 = — 0.25 × 180 L. — 2.00 = — 0.75 × 180	R. — 0.75 L. — 2.25 = — 0.50 × 180
Case 29.....	R. — 2.75 = — 1.75 × 180 L. — 2.50 = — 0.75 × 180	R. — 2.75 = — 1.50 × 180 L. — 2.50 = — 0.75 × 180
Case 30.....	R. — 3.00 = — 0.50 × 170 L. — 3.00 = — 0.25 × 20	R. — 4.50 L. — 4.50
Case 32.....	R. — 3.00 = — 0.50 × 90 L. — 3.25 = — 0.25 × 80	R. — 3.00 = — 0.50 × 90 L. — 3.00 = — 0.37 × 90
Case 33.....	R. — 0.75 = — 0.50 × 180 L. — 0.75 = — 0.50 × 175	R. — 1.25 = — 0.50 × 180 L. — 0.50 = — 0.25 × 180
Case 34.....	R. — 2.25 = — 0.75 × 165 L. — 3.50 = — 1.00 × 175	R. — 3.00 = — 0.50 × 180 L. — 4.00 = — 0.50 × 180
Case 35.....	R. — 3.25 = — 0.25 × 165 L. — 2.75 = — 0.50 × 160	R. — 3.50 = — 1.00 × 175 L. — 3.75
Case 37.....	R. — 2.0 = — 0.75 × 130 L. — 2.0 = — 0.50 × 180	R. — 3.00 L. — 3.25
Case 38.....	R. — 3.25 L. — 3.25 = — 0.50 × 35	R. — 2.50 = — 0.50 × 180 L. — 3.25 = — 0.50 × 35
Case 40.....	R. — 7.0 = — 1.0 × 180 L. — 7.0 = — 0.50 × 180	R. — 6.75 = — 1.0 × 180 L. — 6.50 = — 0.50 × 180
Case 42.....	R. — 2.75 L. — 2.75 = — 0.25 × 170	R. — 2.75 L. — 2.75
Case 43.....	R. — 2.75 L. — 2.75 = — 0.25 × 180	R. — 2.75 L. — 2.75
Case 45.....	R. — 0.50 L. — 0.75	R. — 0.50 L. — 0.75
Case 46.....	R. — 4.00 = — 0.50 × 165 L. — 4.0 = — 0.50 × 180	R. — 4.0 = — 0.50 × 180 L. — 4.0 = — 0.37 × 20
Case 50.....	R. — 2.50 = — 0.75 × 5 L. — 2.25 = — 0.50 × 180	R. — 2.50 L. — 2.50
Case 51.....	R. — 3.75 = — 0.50 × 180 L. — 3.75 = — 0.75 × 180	R. — 3.87 = — 0.50 × 180 L. — 3.87 = — 0.75 × 180
Case 52.....	R. — 5.0 = — 2.25 × 15 L. — 4.0 = — 2.50 × 165	R. — 5.50 = — 1.50 × 15 L. — 4.25 = — 3.25 × 165
Case 53.....	R. — 4.0 L. — 4.0	R. — 4.0 = — 0.50 × 180 L. — 4.50

TABLE VIII.—Continued
Retinoscopic Findings Before and After "Visual Training."

	Before Visual Training	After Visual Training
Case 54.....	R. — 1.50 L. — 1.25	R. — 1.37 L. — 1.25
Case 55.....	R. — 4.0 = — 0.25 × 90 L. — 3.75 = — 0.50 × 90	R. — 4.25 = — 0.50 × 90 L. — 4.0 = — 0.50 × 90
Case 56.....	R. — 1.25 = + 2.25 × 90 L. — 2.0 = — 3.50 × 165	R. — 1.25 = + 2.0 × 90 L. — 2.0 = + 3.50 × 165
Case 57.....	R. — 2.0 L. — 4.0 = — 0.50 × 180	R. — 2.25 L. — 4.0 = — 0.50 × 180
Case 59.....	R. — 3.0 L. — 3.0 = — 0.25 × 180	R. — 3.25 L. — 3.25
Case 69.....	R. — 1.50 = — 1.25 × 15 L. — 1.50 = — 1.0 × 165	R. — 2.0 = — 0.75 × 180 L. — 2.25 = — 0.75 × 180
Case 71.....	R. — 6.50 = — 0.50 × 90 L. — 6.50 = — 0.50 × 90	R. — 7.0 = — 0.50 × 90 L. — 6.50 = — 0.50 × 90
Case 75.....	R. — 4.0 = — 3.0 × 180 L. — 6.0 = — 2.50 × 160	R. — 4.0 = — 3.0 × 180 L. — 5.50 = — 2.50 × 180
Case 76.....	R. — 0.50 = — 0.25 × 135 L. — 0.75	R. — 0.50 = — 0.25 × 135 L. — 0.75
Case 77.....	R. — 0.50 × 90 L. — 0.50	R. — 0.75 = + 0.25 × 90 L. — 0.75
Case 78.....	R. — 6.25 L. — 5.50 = — 0.75 × 180	R. — 6.50 L. — 6.25 = — 0.50 × 180
Case 79.....	R. — 1.75 = — 0.25 × 180 L. — 1.50 = — 0.25 × 180	R. — 1.75 L. — 2.0
Case 81.....	R. — 2.0 L. — 2.0	R. — 2.25 L. — 2.0
Case 84.....	R. — 0.75 L. — 0.50	R. — 1.75 L. — 2.0
Case 85.....	R. — 3.25 L. — 2.0	R. — 3.0 L. — 1.50 = — 0.75 × 180
Case 87.....	R. — 3.50 = — 0.25 × 90 L. — 3.75	R. — 3.25 L. — 3.25 = — 0.25 × 90
Case 89.....	R. — 2.50 L. — 2.75 = — 0.25 × 180	R. — 1.75 = — 0.25 × 180 L. — 1.75 = — 0.25 × 180
Case 90.....	R. — 4.25 L. — 2.0 = — 0.50 × 90	R. — 4.50 L. — 2.50 = — 0.50 × 180
Case 91.....	R. — 4.25 L. — 4.50	R. — 3.50 = — 0.25 × 180 L. — 4.25
Case 94.....	R. — 2.50 = — 0.50 × 180 L. — 2.25	R. — 2.50 = — 0.50 × 180 L. — 2.25
Case 95.....	R. — 1.50 = — 0.50 × 90 L. — 2.0 = — 0.25 × 90	R. — 1.75 = — 0.25 × 90 L. — 2.0 = — 0.25 × 90
Case 96.....	R. — 1.25 = — 0.50 × 20 L. — 1.50 = — 0.50 × 135	R. — 1.25 L. — 1.25
Case 97.....	R. — 1.00 = — 0.25 × 90 L. — 1.00 = — 0.25 × 90	R. — 0.75 L. — 1.0
Case 99.....	R. — 0.50 = — 0.50 × 175 L. — 0.75 = — 0.25 × 180	R. — 1.25 = + 0.50 × 75 L. — 1.25 = + 0.50 × 90
Case 100.....	R. — 0.37 L. — 0.37 = — 0.25 × 25	R. — 0.75 L. — 0.75 = — 0.25 × 180
Case 101.....	R. — 2.25 = — 0.50 × 95 L. — 2.75 = — 0.50 × 85	R. — 2.50 = — 0.25 × 90 L. — 2.75 = — 0.25 × 85
Case 103.....	R. — 4.0 = — 0.75 × 180 L. — 4.50 = — 0.50 × 175	R. — 3.75 = — 0.75 × 180 L. — 5.0 = — 0.50 × 175
Case 105.....	R. — 1.25 = — 0.75 × 180 L. — 0.75 = — 0.75 × 180	R. — 1.25 = — 1.0 × 180 L. — 0.75 = — 0.50 × 180
Case 106.....	R. — 2.75 L. — 2.0 = — 0.25 × 180	R. — 2.75 L. — 2.50

TABLE VIII.—Continued
Retinoscopic Findings Before and After "Visual Training."

	Before Visual Training	After Visual Training
Case 107.....	R. — 1.75 = — 0.50 × 180 L. — 2.0 = — 0.25 × 180	R. — 1.50 = — 0.50 × 180 L. — 1.75 = — 0.50 × 180
Case 108.....	R. — 0.37 L. — 0.62	R. — 0.75 L. — 1.50
Case 112.....	R. — 2.50 L. — 2.50	R. — 2.50 L. — 2.50
Case 121.....	R. — 3.25 = — 0.25 × 90 L. — 4.0 = — 0.75 × 180	R. — 3.75 L. — 4.0 = — 0.75 × 160
Case 122.....	R. — 4.0 L. — 4.0	R. — 4.0 L. — 4.0 = — 0.50 × 90
Case 124.....	R. — 1.50 L. — 1.25 = — 0.25 × 180	R. — 1.25 = — 0.50 × 20 L. — 0.75
Case 126.....	R. — 1.25 = — 0.50 × 180 L. — 1.25 = — 0.50 × 180	R. — 1.50 = — 0.75 × 180 L. — 1.50 = — 0.50 × 180
Case 127.....	R. — 3.25 = — 0.25 × 90 L. — 2.25 = — 0.25 × 180	R. — 2.75 L. — 2.75
Case 131.....	R. — 2.0 L. — 1.75 = — 0.25 × 180	R. — 2.0 L. — 1.75

group of myopic individuals of similar age and degree of myopia whose visual acuity without correction was determined at the times of the first and second examination and who were not subjected to visual training and did not wear glasses. However, the absence of a control group is unimportant. Every ophthalmologist will concede that within a three-months' period without any treatment, a group of 103 myopic individuals would show no significant improvement in their uncorrected vision. The one pertinent question is, therefore: Are the changes in the percentage visual acuity noted in these patients of any significance? These figures disclose several points pertinent to this question.

First. The uncorrected visual acuity varied within wide limits in individuals with approximately the same degree of myopia. For example, patients 1 and 14 with approximately the same degree of myopia (—1.75D. sph. and —1.75D. sph. = —.25D. cyl. ax. 80°) had 16/200 and 20/200 vision, whereas 63 and 79, with myopic errors of —1.75D. sph. = —.25D. cyl. ax. 180°, showed visual acuity of 20/100 + 1 and 20/100. The average percentage visual acuity of these four

patients with practically identical refractive errors was, respectively, 13, 24, 42, and 42, a swing of 29 points. Similar variations (table IX) occurred in all grades of myopia. The visual acuity of any myopic person is obviously influenced by a large subjective element—the individual interpretation of a blurred retinal image.

Second. There was often an amazing swing in the percentage visual acuity of the same individual on the same day when vision was tested on different charts. This, for example, was exhibited in case 5, wherein percentage visual acuity, varied from 20 to 41; case 8, from 20 to 58; case 17, from 1 to 49; and case 57, from 8 to 73! Swings of from 20 to 30 points in the different charts were the rule rather than the exception in patients with an average percentage visual acuity in the mid-range. This swing was irregular, some patients doing better on one chart than on another.

Third. The method of computing the results on the basis of a change in the percentage visual acuity weights the scales in favor of an improvement according to the severity of the myopia. Thus an individual with high myopia who has an initial 10/200 vision has a percentage

CHART IX.

Results of Visual Acuity Tests and % Evaluation of Vision.

		Before Training	Visual Acuity %	After Training	Visual Acuity %	Difference %
CASE 1		$-1.75 = 20/20 +4$		$-1.75 = -0.50 \times 180 = 20/20$		
Letters	RE	16/200	13	20/200	20	+7
	LE	15/200	11	20/100	49	+38
Landolt	RE	12/200	7	20/175	26	+19
	LE	10/200	3	20/125	40	+37
E	RE	20/200	20	20/80 +2	59	+39
	LE	18/200	17	20/80	58	+41
Numbers	RE	15/200	11	20/100 +1	49	+38
	LE	12/200	7	20/70 -1	60	+53
CASE 1		Third Test				
Letters	RE	20/100	49	.....	..	....
	LE	20/100 -1	37	.....	..	....
Landolt	RE	20/150	31	.....	..	....
	LE	20/150	31	.....	..	....
E	RE	20/80 -2	56	.....	..	....
	LE	20/80 -2	56	.....	..	....
Numbers	RE	20/200 +1	37	.....	..	....
	LE	20/100	49	.....	..	....
CASE 2		$-0.75 = +0.25 \times 90 = 20/15 -4$		$-0.25 = -0.37 \times 180 = 20/20 +4$		
Letters	RE	20/20 +1	100 +	20/20 -1	99 -	-1
	LE	20/20 +4	100 +	20/15 -2	100 +	+ -
Landolt	RE	20/40	84	20/30	92	+8
	LE	20/30	92	20/25	96	+4
E	RE	20/25	96	20/20 +3	100 +	+4
	LE	20/20	100	20/15	100 +	+
Numbers	RE	20/20 -1	100 -	20/20 +2	100 +	+
	LE	20/20 -1	100 -	20/15 -3	100 +	+
CASE 3		$-0.37 = 20/15$		$-1.12 = 20/15$		
Letters	RE	20/40 -1	82	20/20 -2	100 -	+18
	LE	20/60	70	20/20 -4	100 -	+30
Landolt	RE	20/60 -1	69	20/45 -2	79	+10
	LE	20/85	56	20/45 +1	81	+25
E	RE	20/30	92	20/20 -4	100 -	+8
	LE	20/50	76	20/25	96	+20
Numbers	RE	20/30 -2	90	20/20 -4	100 -	+10
	LE	20/50	76	20/30 -1	91	+15
CASE 4		$-0.50 = -0.25 \times 90 = 20/15$		$-0.25 = -0.50 \times 60 = 20/15$		
Letters	RE	20/40 +1	83	20/15	100 +	+17
	LE	20/20 -1	99	20/15 -2	100 +	+1
Landolt	RE	20/60 +1	70	20/25	96	+26
	LE	20/40	83	20/17.5	100 +	+17
E	RE	20/40	83	20/15 -2	100 +	+17
	LE	20/20 -1	100 -	20/15	100 +	+
Numbers	RE	20/40 +1	83 +	20/20 +2	100 +	+17
	LE	20/20 -1	100 -	20/15	100 +	+
CASE 5		$-0.25 \times 90 = 20/15$		$-1.25 = 20/15$		
Letters	RE	20/15 -2	100 +	20/15 -1	100 +	+ -
	LE	20/200	20	20/70	64	+44
Landolt	RE	20/20 -4	100 -	20/25 -1	95	-5
	LE	20/125	37	20/175	26	-11
E	RE	20/15	100 +	20/15	100 +	+ -
	LE	20/120	41	20/80 -2	58	+17
Numbers	RE	20/15 -3	100 +	20/20 -1	100 -	+ -
	LE	20/200	20	17/70 -1	58	+38
CASE 6		$-1.00 = 20/15$		$-0.75 = 20/15$		
Letters	RE	20/40	83	20/30	92	+9
	LE	20/40 +2	84	20/40	83	-1
Landolt	RE	20/60 -1	70	20/85	56	-14
	LE	20/60 +1	70	20/70 -1	64	-6
E	RE	20/50	76	20/40	83	+7
	LE	20/40 -2	81	20/40 +3	89	+8
Numbers	RE	20/50 +1	77	20/40 -1	83	+6
	LE	20/40	83	20/40 -1	82	-1
CASE 7		$-0.75 = 20/15 -1$		$-0.50 = -0.25 = 20/15$		
Letters	RE	20/30 -2	91	20/30 -2	91	+ -
	LE	20/25 -2	95	20/30	92	-3
Landolt	RE	20/70 -1	63	20/100	49	-14
	LE	20/70 -1	63	20/60 -1	69	+6
E	RE	20/30 -2	91	20/50 -2	75	-16
	LE	20/40	84	20/30 -1	91	+7
Numbers	RE	20/70 +2	65	20/50 +2	77	+12
	LE	20/40	84	20/40 -3	82	-2

CHART IX.—Continued.

Results of Visual Acuity Tests and % Evaluation of Vision.

		Before Training	Visual Acuity %	After Training	Visual Acuity %	Difference %
CASE 8						
		$-1.50 = -0.25 \times 180 = 20/20 -4$		$-1.37 = -0.25 \times 40 = 20/15$		
Letters	RE.....	20/100	49	20/60 -2	68	+19
	LE.....	20/60 +1	71	20/50	76	+5
Landolt	RE.....	20/85 -1	55	20/125	37	-18
	LE.....	20/125	37	20/100	49	+12
E	RE.....	20/80	58	20/80	58	+ -
	LE.....	20/80	58	20/50 -2	74	+16
Numbers	RE.....	20/200	20	20/70	64	+44
	LE.....	20/50 -1	76	20/50	76	+ -
CASE 9						
		$-2.50 = 20/20$		$-2.75 = -0.50 \times 10 = 20/20$		
Letters	RE.....	20/200	20	20/200	20	+ -
	LE.....	20/200	20	15/50	66	+46
Landolt	RE.....	20/200	20	20/200	20	+ -
	LE.....	20/200	20	15/200	15	-5
E	RE.....	20/200	20	20/80 -1	58	+38
	LE.....	20/200	20	15/70	54	+34
Numbers	RE.....	10/200	3	20/200	20	+17
	LE.....	20/200 -1	12	15/70	54	+42
CASE 9						
		Third Test				
Letters	RE.....	20/100	49	.....	..	....
	LE.....	20/100 -1	37	.....	..	....
Landolt	RE.....	20/150	31	.....	..	....
	LE.....	20/150	31	.....	..	....
E	RE.....	20/160	29	.....	..	....
	LE.....	20/120	41	.....	..	....
Numbers	RE.....	20/200	20	.....	..	....
	LE.....	20/200	20	.....	..	....
CASE 10						
		$-2.50 = 20/15$		$-2.25 = 20/15$		
Letters	RE.....	20/200	20	20/200	20	+ -
	LE.....	20/100 +1	53	20/100 -1	37	-16
Landolt	RE.....	10/200	3	15/200	15	+12
	LE.....	20/200	20	20/150	31	+11
E	RE.....	20/160 -1	28	20/120 -1	40	+12
	LE.....	20/80	58	20/80 -2	56	-2
Numbers	RE.....	20/200	20	20/200 -1	12	-8
	LE.....	20/200 +1	37	20/100	49	+12
CASE 12						
		$-2.50 = -0.50 \times 90 = 20/20$		$-2.50 = 20/20$		
Letters	RE.....	20/100 -1	37	20/100	49	+12
	LE.....	20/300	8	20/100	49	+41
Landolt	RE.....	15/200	11	20/200	20	+9
	LE.....	16/200	13	20/200	3	-10
E	RE.....	20/100	49	20/200 +1	37	-12
	LE.....	20/200	20	20/200	20	+ -
Numbers	RE.....	15/200	11	20/200	20	+9
	LE.....	17/200	14	20/200 +1	37	+23
CASE 13						
		$-0.75 = +0.50 = 20/15$		$-0.75 = +0.25 \times 60 = 20/20$		
Letters	RE.....	20/25 -2	94	20/15 -2	100	+6
	LE.....	20/60 -1	68	20/30	92	+24
Landolt	RE.....	20/60	70	20/25 -2	94	+24
	LE.....	20/85 -1	55	20/50 +1	78	+23
E	RE.....	20/20 -2	98	20/15 -1	100 +	+2
	LE.....	20/80	58	20/25 -2	94	+36
Numbers	RE.....	20/30	92	20/15 -2	100 +	+8
	LE.....	20/70 -1	63	20/30 -1	91	+28
CASE 14						
		$-1.75 = 20/20$		$-1.62 = 20/20$		
Letters	RE.....	20/200 +1	37	20/70 -1	59	+22
	LE.....	20/200	20	20/70 -1	59	+39
Landolt	RE.....	13/200	9	20/200	20	+11
	LE.....	18/200	7	20/125	39	+32
E	RE.....	20/120 -1	30	10/40 +2	55	+25
	LE.....	20/160 +1	24	20/120 +1	45	+21
Numbers	RE.....	20/200	20	15/70	52	+32
	LE.....	20/200	20	20/70	64	+44
CASE 15						
		$-2.75 = 20/20 -1$		$-3.75 = -0.50 \times 120 = 20/20 -2$		
Letters	RE.....	20/200	20	20/100	49	+29
	LE.....	20/200	20	20/100 -1	37	+17
Landolt	RE.....	20/200	20	10/200	3	-17
	LE.....	20/200	20	10/200	3	-17
E	RE.....	20/200	20	20/200	20	+ -
	LE.....	20/200	20	20/200	20	+ -
Numbers	RE.....	20/70 -1	60	20/100	49	-11
	LE.....	20/200	20	20/100 +2	59	+39

CHART IX.—Continued.

Results of Visual Acuity Tests and % Evaluation of Vision.

		Before Training	Visual Acuity %	After Training	Visual Acuity %	Difference %
CASE 16						
		$-1.50 = 20/20$		$-1.00 = 20/20$		
Letters	RE	20/60	70	20/30 -3	88	+18
	LE	20/50	77	20/30 -2	90	+13
Landolt	RE	20/50	77	20/35 -1	86	+9
	LE	20/50	77	20/35	87	+10
E	RE	20/40	84	20/25 +4	97	+13
	LE	20/40	84	20/25 -4	94	+10
Numbers	RE	20/30	93	20/30 +1	94	+1
	LE	20/30 -3	88	20/30	92	+4
CASE 17						
		$-4.25 = 20/20 -1$		$-3.00 = 20/20$		
Letters	RE	20/300	8	20/200	20	+12
	LE	20/100	49	20/30 -3	88	+39
Landolt	RE	6/200	1	15/200	11	+10
	LE	10/200	3	20/45	80	+77
E	RE	10/200	3	20/160	29	+26
	LE	20/160	29	20/40	84	+55
Numbers	RE	6/200	1	20/200	20	+19
	LE	8/200	1	20/40 +2	87	+86
CASE 18						
		$-0.75 = -0.37 \times 90 = 20/15$		$-5.50 = 20/15$		
Letters	RE	20/20	100	20/30 -2	90	-10
	LE	20/300	8	10/200	3	-5
Landolt	RE	20/50	76	20/60 -1	68	-8
	LE	20/200	20	10/200	3	-17
E	RE	20/30	92	20/30 -1	91	-1
	LE	20/160	38	15/200	11	-27
Numbers	RE	20/30 -2	90	20/30 -2	90	+ -
	LE	10/200	3	10/200 +1	9	+6
CASE 20						
		$-0.75 = 20/20$		$-1.00 = 20/20$		
Letters	RE	20/70	64	20/50 +2	80	+16
	LE	20/70	64	20/20 -3	97	+33
Landolt	RE	20/70	64	20/50 -1	75	+11
	LE	20/70	64	20/70 -1	60	-4
E	RE	20/60	70	20/30 +3	96	+26
	LE	20/50	76	20/30 -3	88	+12
Numbers	RE	20/50 -2	73	20/50	76	+3
	LE		76	20/30 -1	91	+15
CASE 20						
		Third Test				
Letters	RE	20/40	83	.....	..	....
	LE	20/40	83	.....	..	....
Landolt	RE	20/45	80	.....	..	....
	LE	20/60	70	.....	..	....
E	RE	20/30 +3	96	.....	..	....
	LE	20/30 -2	91	.....	..	....
Numbers	RE	20/40 -2	81	.....	..	....
	LE	20/40 -2	81	.....	..	....
CASE 22 LE						
		$-0.75 = +0.25 \times 90 = 20/15$				
Letters	RE	20/15	100 +	20/15 -2	..	....
	LE	20/30 -1	91	20/40	84	-7
Landolt	RE	20/35	88	20/40	84	-4
	LE	20/50 +2	80	20/100	49	-31
E	RE	20/15 -2	100 +	20/20	100	+ -
	LE	20/30	92	20/40 -1	82	-10
Numbers	RE	20/20 -1	99	20/15 -3	100	+1
	LE	20/20 -4	96	20/40 +3	89	-7
CASE 23						
		$-2.00 = -0.50 \times 10 = 20/20$		$-1.50 = 20/20$		
Letters	RE	20/200	20	15/200	11	-9
	LE	20/80	59	20/70 -1	60	+1
Landolt	RE	10/200	3	10/70	34	+31
	LE	20/100	54	20/175	25	-29
E	RE	20/200	20	10/80	29	+9
	LE	20/60	70	20/80 +2	62	-8
Numbers	RE	20/200 -1	14	15/200	11	-3
	LE	20/70 -1	59	20/70 +1	66	+7
CASE 26						
		$-1.25 = -0.25 \times 90 = 20/20$		$-1.25 = -0.25 \times 80 = 20/20$		
Letters	RE	20/100	49	20/200	20	-29
	LE	20/70 -1	60	20/70 +1	66	+6
Landolt	RE	20/200	20	10/125	13	-7
	LE	20/100	49	20/175 -1	23	-26
E	RE	15/200	11	15/80	49	+38
	LE	20/60	70	15/160	17	-53
Numbers	RE	15/200	11	20/200 +1	37	+26
	LE	20/70 +1	66	20/100 -1	37	-29

CHART IX.—Continued.

Results of Visual Acuity Tests and % Evaluation of Vision.

		Before Training	Visual Acuity %	After Training	Visual Acuity %	Difference %
CASE 27						
		$-2.50 = -0.50 \times 85 = 20/20$		$-2.62 = 20/20$		
Letters	RE.....	20/200	20	10/100	20	+1
	LE.....	20/200	20	20/100 -1	37	+17
Landolt	RE.....	12/200	8	10/125	13	+5
	LE.....	18/200	17	20/200	20	+3
E	RE.....	20/200	20	10/80	38	+18
	LE.....	20/160	39	20/80	59	+20
Numbers	RE.....	12/200	8	10/70	34	+26
	LE.....	20/200	20	20/100	49	+29
CASE 28						
		$-0.62 = -0.25 \times 180 = 20/20$		$-2.00 = -0.75 \times 180 = 20/20$		
Letters	RE.....	20/30	92	20/20 -4	96	+4
	LE.....	20/400	3	10/30 -1	68	+65
Landolt	RE.....	20/35	87	20/45	80	-7
	LE.....	15/200	11	10/70	34	+23
E	RE.....	20/40	84	20/25	96	+12
	LE.....	20/160 +1	24	10/25	76	+52
Numbers	RE.....	20/30 -2	90	20/30 -3	88	-2
	LE.....	20/100	49	10/40 -2	56	+7
CASE 29						
		$-2.75 = -1.75 \times 180 = 20/25$		$-2.50 = -0.75 \times 180 = 20/20$		
Letters	RE.....	20/400	3	15/200	3	+1
	LE.....	20/400	3	10/70 -1	28	+25
Landolt	RE.....	6/200	1	10/175 -1	4	+3
	LE.....	10/200	3	10/100	20	+17
E	RE.....	10/200	3	10/160	7	+4
	LE.....	7/160	7	10/80	28	+21
Numbers	RE.....	8/200	2	10/200 +1	4	+2
	LE.....	10/200	3	10/70 -1	28	+25
CASE 30						
		$-3.00 = -0.50 \times 170 = 20/20$		$-3.00 = -0.25 \times 20 = 20/20$		
Letters	RE.....	20/200	20	20/70	64	+44
	LE.....	20/200	20	20/70 -1	60	+40
Landolt	RE.....	10/200	3	20/125	37	+34
	LE.....	15/200	11	20/175	25	+14
E	RE.....	20/200	20	20/120	41	+21
	LE.....	15/200	11	20/120	41	+30
Numbers	RE.....	12/200	8	20/200	20	+12
	LE.....	18/200	17	20/200	20	+3
CASE 30						
		Third Test				
Letters	RE.....	20/100 -1	37	.....	..	....
	LE.....	20/100	49	.....	..	....
Landolt	RE.....	17/200	14	.....	..	....
	LE.....	17/200	14	.....	..	....
E	RE.....	20/160	29	.....	..	....
	LE.....	18/200	7	.....	..	....
Numbers	RE.....	20/200 +1	37	.....	..	....
	LE.....	20/100	49	.....	..	....
CASE 31						
		$-0.62 = -0.50 \times 90 = 20/20$		$-0.75 = -0.50 \times 100 = 20/20$		
Letters	RE.....	20/60 -1	68	20/50 +2	80	+12
	LE.....	20/30 -2	90	20/50 -1	75	-15
Landolt	RE.....	20/100	49	20/175	25	-24
	LE.....	20/40	84	20/85	56	-28
E	RE.....	20/40	84	20/80 +2	62	-22
	LE.....	20/30 -3	88	20/60 +2	72	-16
Numbers	RE.....	20/70 -1	60	20/50 -1	75	+15
	LE.....	20/40 -1	82	20/50 -3	71	-11
CASE 32						
		$-3.00 = -0.62 \times 95 = 20/20$		$-3.25 = -0.25 \times 80 = 20/20 -2$		
Letters	RE.....	20/200	20	15/100 -1	27	+7
	LE.....	20/200	20	10/70	34	+14
Landolt	RE.....	20/200	20	15/200	11	-9
	LE.....	10/200	3	10/125 -1	11	+8
E	RE.....	20/160	29	15/80	49	+20
	LE.....	18/200	17	10/80	29	+12
Numbers	RE.....	20/200	20	15/100 +1	43	+23
	LE.....	20/200	20	10/70	34	+14
CASE 33						
		$-0.75 = -0.50 \times 180 = 20/20$		$-0.75 = -0.50 \times 175 = 20/20$		
Letters	RE.....	20/100	49	20/200 +1	37	-12
	LE.....	20/50 -1	75	20/40 +2	87	+12
Landolt	RE.....	20/150	31	20/150	31	+1
	LE.....	20/100 -1	37	20/60 -1	68	+31
E	RE.....	20/80	59	20/120	41	-18
	LE.....	20/40 -1	83	20/40	84	+1
Numbers	RE.....	20/70	64	20/100	49	-15
	LE.....	20/50 -1	75	20/40 -1	82	+7

CHART IX.—Continued.

Results of Visual Acuity Tests and % Evaluation of Vision.

		Before Training	Visual Acuity %	After Training	Visual Acuity %	Difference %
CASE 34						
		$-2.25 = -0.75 \times 65 = 20/20$		$-3.50 = -1.00 \times 175 = 20/15 -4$		
Letters	RE.....	12/200	8	20/100 +1	54	+46
	LE.....	16/200	13	20/70 -1	60	+47
Landolt	RE.....	10/200	3	20/175 -1	23	+20
	LE.....	6/250	1	20/200	20	+19
E	RE.....	20/200	20	20/120	41	+21
	LE.....	20/200	20	20/160 -1	28	+8
Numbers	RE.....	12/200	8	20/200	20	+12
	LE.....	12/200	8	20/100	40	+41
CASE 34 Third Test						
Letters	RE.....	15/200	11	.....	..	....
	LE.....	10/200	3	.....	..	....
Landolt	RE.....	15/175	16	.....	..	....
	LE.....	15/200	11	.....	..	....
E	RE.....	20/200	20	.....	..	....
	LE.....	15/200	11	.....	..	....
Numbers	RE.....	20/200	20	.....	..	....
	LE.....	12/200	8	.....	..	....
CASE 35						
		$-3.25 = -0.25 \times 165 = 20/20$		$-2.75 = -0.50 \times 160 = 20/20$		
Letters	RE.....	20/200	20	10/100	20	+ -
	LE.....	20/300	8	20/100	49	+41
Landolt	RE.....	17/200	14	10/200	3	-11
	LE.....	8/200	1	20/175	25	+24
E	RE.....	20/200	20	10/80 -2	23	+3
	LE.....	20/200	20	20/160 -1	28	+5
Numbers	RE.....	20/200 -1	14	10/70	34	+20
	LE.....	20/200 -1	14	20/200	20	+6
CASE 36						
		$-1.00 = -0.50 \times 30 = 20/15$		$-1.25 = 20/20$		
Letters	RE.....	20/70 -2	54	20/100 -1	37	-17
	LE.....	20/200	20	20/100	49	+29
Landolt	RE.....	20/150	31	20/150	31	+ -
	LE.....	15/200	11	20/150	31	+20
E	RE.....	20/160	29	20/120	41	+12
	LE.....	20/80	59	20/80 -2	56	-3
Numbers	RE.....	20/200 +1	37	20/100 -1	37	+ -
	LE.....	20/200 +1	37	20/100 -1	37	+ -
CASE 37						
		$-2.00 = -0.75 \times 130 = 20/20$		$-2.00 = 0.50 \times 180 = 20/15 -3$		
Letters	RE.....	20/400	3	20/70	64	+61
	LE.....	17/400	1	20/70 -1	60	+59
Landolt	RE.....	9/150	6	20/200	20	+14
	LE.....	9/200	2	15/200	11	+9
E	RE.....	15/200	11	20/120 -1	30	+19
	LE.....	12/200	8	20/120	41	+33
Numbers	RE.....	9/200	1	20/200 +1	37	+36
	LE.....	8/200	1	20/200 +1	37	+36
CASE 37 Third Test						
Letters	RE.....	20/200	20	.....	..	....
	LE.....	20/100 -1	37	.....	..	....
Landolt	RE.....	20/175 -1	23	.....	..	....
	LE.....	20/175 -1	23	.....	..	....
E	RE.....	20/120 -2	27	.....	..	....
	LE.....	20/120 -2	27	.....	..	....
Numbers	RE.....	20/100 -1	37	.....	..	....
	LE.....	20/100	49	.....	..	....
CASE 38						
		$-3.25 = 20/25$		$-3.25 = -0.50 \times 35 = 20/30 +2$		
Letters	RE.....	15/400	1	10/200	3	+2
	LE.....	15/400	1	10/70 -1	28	+27
Landolt	RE.....	8/200	1	9/200	1	+ -
	LE.....	8/200	1	10/175	5	+4
E	RE.....	8/200	1	10/80	38	+37
	LE.....	9/200	1	10/80 -1	28	+27
Numbers	RE.....	6/100 -1	6	10/70	34	+28
	LE.....	8/200	1	11/200	5	+4
CASE 39						
		$-3.00 = 20/20$		$-3.00 = -0.25 \times 90 = 20/20$		
Letters	RE.....	12/400	1	15/200	11	+10
	LE.....	20/400	3	15/200	11	+8
Landolt	RE.....	9/200	1	10/200	3	+2
	LE.....	10/200	3	10/100 -1	14	+11
E	RE.....	17/200	14	10/80	29	+15
	LE.....	9/200	1	10/80	29	+28
Numbers	RE.....	6/200	1	15/200 -1	6	+5
	LE.....	16/200	13	12/200	8	-5

CHART IX.—Continued.

Results of Visual Acuity Tests and % Evaluation of Vision.

		Before Training	Visual Acuity %	After Training	Visual Acuity %	Difference %
CASE 40		$-7.00 = -1.00 \times 180 = 20/20$		$-7.00 = -1.00 \times 180 = 20/20$		
Letters	RE.....	8/200	1	20/200	20	+19
	LE.....	9/200	1	10/200	3	+2
Landolt	RE.....	7/200	1	15/175 -1	11	+10
	LE.....	5/200	1	10/175 -1	5	+4
E	RE.....	5/200	1	10/80	29	+28
	LE.....	5/200	1	10/80	29	+28
Numbers	RE.....	5/200	1	15/200 -1	6	+5
	LE.....	10/200	3	10/100 +2	48	+45
CASE 41		$-1.50 = -0.25 \times 175 = 20/20$		$-1.50 = -0.25 \times 180 = 20/20$		
Letters	RE.....	14/200	10	20/40 -1	82	+72
	LE.....	10/70 -1	28	20/100 -1	37	+9
Landolt	RE.....	12/200	8	20/125	39	+31
	LE.....	10/125	13	20/175	25	+12
E	RE.....	17/160	24	20/60 +4	75	+51
	LE.....	19/100	47	20/120 -1	30	-17
Numbers	RE.....	17/100	41	20/50 -2	73	+32
	LE.....	10/70	34	20/100 -2	35	+1
CASE 41		Third Test				
Letters	RE.....	20/200	20	.....	..	....
	LE.....	20/200	20	.....	..	....
Landolt	RE.....	10/200	3	.....	..	....
	LE.....	20/200	20	.....	..	....
E	RE.....	20/200	20	.....	..	....
	LE.....	20/120 -1	34	.....	..	....
Numbers	RE.....	20/200 -1	12	.....	..	....
	LE.....	20/200	20	.....	..	....
CASE 42		$-2.75 = 20/15 -2$		$-2.75 = -0.25 \times 170 = 20/15 -3$		
Letters	RE.....	20/100 -1	37	20/200	20	-17
	LE.....	10/100	20	15/100	33	+13
Landolt	RE.....	13/200	9	10/85 -1	23	+14
	LE.....	16/200	13	15/200	11	-2
E	RE.....	20/200	20	20/200	20	+ -
	LE.....	15/200	11	20/200	20	+9
Numbers	RE.....	18/200	17	20/200	20	+3
	LE.....	10/100 -1	14	15/100	33	+19
CASE 44		$-2.75 = -0.25 \times 180 = 20/20$		$-2.25 = -0.25 \times 70 = 20/20$		
Letters	RE.....	15/200	11	20/200	20	+9
	LE.....	20/200	20	20/200 +1	37	+17
Landolt	RE.....	10/200	3	10/175	5	+2
	LE.....	7/200	1	10/60	41	+40
E	RE.....	11/200	5	20/120	41	+36
	LE.....	17/200	14	10/30 +1	71	+57
Numbers	RE.....	18/200	17	20/200	20	+3
	LE.....	16/200	13	20/200	20	+7
CASE 45		$-0.50 = 20/20$		$-0.75 = 20/20$		
Letters	RE.....	20/30	92	20/50	76	-16
	LE.....	20/50 -2	73	20/40 -2	81	+8
Landolt	RE.....	20/70	64	20/125	39	-25
	LE.....	20/100 -1	44	20/125 -1	35	-9
E	RE.....	20/40	84	20/50 +2	80	-4
	LE.....	20/50	76	20/50	76	+ -
Numbers	RE.....	20/50	76	20/40 -3	80	+4
	LE.....	20/40	84	20/50 +2	80	-4
CASE 46		$-4.00 = -0.50 \times 165 = 20/20$		$-4.00 = -0.50 \times 180 = 20/20$		
Letters	RE.....	15/200	11	10/200 -1	5	-6
	LE.....	20/200	20	17/200	14	-6
Landolt	RE.....	8/200	1	10/150	8	+7
	LE.....	19/200	19	10/150	8	-11
E	RE.....	8/160	3	10/120 +2	12	+9
	LE.....	15/160	20	10/80	29	+9
Numbers	RE.....	10/100 -1	14	10/70 +2	37	+23
	LE.....	15/200	11	10/100	20	+9
CASE 48		$-6.00 = 20/20 -1$		$-5.25 = 20/20 -1$		
Letters	RE.....	20/300	8	10/200	3	-5
	LE.....	20/400	3	10/70	34	+31
Landolt	RE.....	7/200	1	10/200	3	+2
	LE.....	7/200	1	10/125 -1	11	+10
E	RE.....	11/200	5	10/160	7	+2
	LE.....	12/200	8	10/120	14	+6
Numbers	RE.....	8/200	1	10/70 -1	28	+27
	LE.....	10/200	3	10/70 -1	28	+25

CHART IX.—Continued.

Results of Visual Acuity Tests and % Evaluation of Vision.

		Before Training	Visual Acuity %	After Training	Visual Acuity %	Difference %
CASE 49						
		$-3.75 = -0.50 \times 180 = 20/20$		$-2.00 = -0.50 \times 180 = 20/20$		
Letters	RE	20/400	3	10/200	3	+—
	LE	20/400	3	10/100	37	+34
Landolt	RE	8/200	1	10/200	3	+2
	LE	9/175	4	10/150	8	+4
E	RE	7/200	1	10/120 +1	17	+16
	LE	8/200	1	10/80 -1	24	+23
Numbers	RE	7/100	9	10/200	3	-6
	LE	8/200	1	10/70 -1	28	+27
CASE 50						
		$-2.50 = -0.75 \times 5 = 20/20$		$-2.25 = -0.50 \times 180 = 20/30 +2$		
Letters	RE	18/200	17	20/100 -1	37	+20
	LE	18/200	17	20/200	20	+3
Landolt	RE	12/200	8	20/175 -1	23	+15
	LE	12/200	8	15/200	11	+3
E	RE	20/160	29	20/160	29	+—
	LE	20/160	29	20/200	20	-9
Numbers	RE	15/200	11	20/100	49	+38
	LE	15/200	11	15/100	33	+22
CASE 51						
		$-3.75 = -0.50 \times 180 = 20/15$		$-3.75 = -0.75 \times 180 = 20/15 -4$		
Letters	RE	12/200	8	10/200	3	-5
	LE	10/200	3	10/100	20	+17
Landolt	RE	10/200	3	10/175 -1	4	+1
	LE	8/200	1	10/150	8	+7
E	RE	15/200	11	10/120	14	+3
	LE	12/200	8	10/80	29	+21
Numbers	RE	12/200	8	10/200 +1	9	+1
	LE	6/200	1	10/200 +1	9	+8
CASE 52						
		$-5.00 = -2.25 \times 15 = 20/30 +3$		$-4.00 = -2.50 \times 165 = 20/20 -3$		
Letters	RE	15/400	1	10/200	3	+2
	LE	20/400	3	20/100 -1	37	+34
Landolt	RE	9/200	1	10/125	13	+12
	LE	12/200	8	20/200	20	+12
E	RE	8/200	1	20/160 -2	23	+22
	LE	8/200	1	20/160 +1	38	+37
Numbers	RE	8/200	1	20/200	20	+19
	LE	10/200	3	20/200 +1	37	+34
CASE 52						
		Third Test				
Letters	RE	10/200	3	.....	..	....
	LE	10/200	3	.....	..	....
Landolt	RE	7/175	1	.....	..	....
	LE	10/175	5	.....	..	....
E	RE	10/160	6	.....	..	....
	LE	10/120	9	.....	..	....
Numbers	RE	10/200	3	.....	..	....
	LE	10/200	3	.....	..	....
CASE 53						
		$-4.00 = 20/20$		$-4.00 = 20/20$		
Letters	RE	10/200	3	20/70	64	+61
	LE	8/200	1	20/70 +1	66	+65
Landolt	RE	15/200	11	20/85	56	+45
	LE	10/200	3	20/125	39	+36
E	RE	14/200	10	20/160 +1	38	+28
	LE	9/200	1	20/160	29	+28
Numbers	RE	12/200	8	20/100 +2	49	+41
	LE	10/200	3	20/100	59	+56
CASE 54						
		$-1.50 = 20/15$		$-1.25 = 20/15$		
Letters	RE	20/50 +1	78	20/50	76	-2
	LE	20/50 +2	80	20/50 +1	78	-2
Landolt	RE	20/125	39	20/100	49	+10
	LE	20/80	56	20/85	56	+—
E	RE	20/60	70	20/80	59	-11
	LE	20/50	76	20/40 -3	79	+3
Numbers	RE	20/70 -1	60	20/70 +1	66	+6
	LE	20/70 +1	66	20/50 +2	80	+14
CASE 55						
		$-4.00 = -0.25 \times 90 = 20/20$		$-3.75 = -0.50 \times 90 = 20/20$		
Letters	RE	20/100	49	20/100 -1	37	-12
	LE	20/200	20	10/200	20	+—
Landolt	RE	10/200	3	15/200	11	+8
	LE	10/200	3	10/175	5	+2
E	RE	20/200	20	20/160	29	+9
	LE	20/120	41	10/120	14	-27
Numbers	RE	20/200 -1	14	12/200	8	-6
	LE	18/200	17	10/100 +1	37	+20

CHART IX.—Continued.

Results of Visual Acuity Tests and % Evaluation of Vision.

		Before Training	Visual Acuity %	After Training	Visual Acuity %	Difference %
CASE 56		$-1.25 = -2.25 \times 90 = 20/30$		$-2.00 = -3.50 \times 165 = 20/40$		
Letters	RE					
	LE	20/100	49	10/100	20	-29
Landolt	RE					
	LE	20/200	20	10/175	5	-15
E	RE					
	LE	20/200	20	10/120	14	-6
Numbers	RE					
	LE	20/300	8	7/100 -1	14	+6
CASE 57		$-2.00 = 20/20$		$-4.00 = -0.50 \times 180 = 20/20$		
Letters	RE	20/200	20	20/50 -2	73	+53
	LE	9/200	1	20/70 -1	60	+59
Landolt	RE	20/200	20	20/85	56	+36
	LE	8/200	1	20/50	76	+75
E	RE	20/120	41	20/30 -3	88	+47
	LE	12/200	8	20/40 -2	81	+73
Numbers	RE	20/100	49	20/50 -2	73	+24
	LE	12/200	8	20/70	64	+56
CASE 57		Third Test				
Letters	RE	20/70	64			
	LE	20/200	20			
Landolt	RE	10/150	8			
	LE	10/175	5			
E	RE	20/80	50			
	LE	10/160	6			
Numbers	RE	20/50 -2	73			
	LE	10/200	3			
CASE 58		$-1.00 = -0.25 \times 180 = 20/20$		$-0.50 = 20/20$		
Letters	RE	20/70 -1	60	20/40 +2	87	+27
	LE	20/30	92	20/40 -1	82	-10
Landolt	RE	20/125	39	20/200	20	-19
	LE	20/50	76	20/60 -1	68	-8
E	RE	20/80 +2	62	20/50	76	+14
	LE	20/25 -3	92	20/30 -1	91	-1
Numbers	RE	20/100 -1	37	20/40 -1	82	+45
	LE	20/30 -3	88	20/30	92	+4
CASE 59		$-3.00 = 20/20$		$-3.00 = -0.25 \times 180 = 20/20$		
Letters	RE	15/200	11	10/100	20	+9
	LE	20/200	20	10/100 +1	37	+17
Landolt	RE	10/200	3	10/175	5	+2
	LE	10/200	3	10/175	5	+2
E	RE	20/200	20	10/80	29	+9
	LE	20/200	20	10/80 -1	24	+4
Numbers	RE	10/200	3	10/200	3	+ -
	LE	10/200	3	10/100 -1	14	+11
CASE 60		$-1.00 = -0.25 \times 15 = 20/20$		$-2.25 = -0.25 \times 90 = 20/20$		
Letters	RE	20/100 +1	54	20/50 -1	75	+21
	LE	20/200	20	20/50	77	+57
Landolt	RE	18/200	17	20/60 -1	68	+51
	LE	13/200	9	20/85	56	+47
E	RE	20/80	59	20/80 -1	55	-4
	LE	20/200	20	20/120	41	+21
Numbers	RE	20/70	64	20/100	49	-15
	LE	20/200	20	20/100	49	+29
CASE 60		Third Test				
Letters	RE	20/70	64			
	LE	10/70 +1	40			
Landolt	RE	20/150	31			
	LE	5/175	1			
E	RE	20/80	59			
	LE	20/160	29			
Numbers	RE	20/70 -1	59			
	LE	10/70	34			
CASE 63		$-1.75 = -0.25 \times 180 = 20/20$		$-1.50 = -0.25 \times 180 = 20/20$		
Letters	RE	20/100 +1	54	20/40 -1	82	+28
	LE	20/100	49	20/50 +2	80	+31
Landolt	RE	20/200	20	20/85 +1	61	+41
	LE	20/125 -1	23	20/85 -1	55	+32
E	RE	20/80	59	20/30 -5	86	+27
	LE	20/60	70	20/50	76	+6
Numbers	RE	20/200 +1	37	20/30 -3	88	+51
	LE	20/100	49	15/70 +2	56	+7

CHART IX.—Continued.

Results of Visual Acuity Tests and % Evaluation of Vision.

		Before Training	Visual Acuity %	After Training	Visual Acuity %	Difference %
CASE 63						
		Third Test				
Letters	RE.....	20/50 -3	72	.....	...	....
	LE.....	20/50 -3	72	.....	..	....
Landolt	RE.....	20/100 -1	37	.....	..	....
	LE.....	20/85	56	.....	..	....
E	RE.....	20/60 -2	66	.....	..	....
	LE.....	20/50 -2	74	.....	..	....
Numbers	RE.....	20/50 -3	72	.....	..	....
	LE.....	20/70 -1	59	.....	..	....
CASE 64						
		$-7.50 = 20/20 -4$				
Letters	RE.....	7/100 -1	7	10/200	3	-4
	LE.....	5/100	3	10/100 -1	14	+11
Landolt	RE.....	7/200	1	10/200	3	+2
	LE.....	5/125	1	10/175	5	+4
E	RE.....	10/200	3	10/160	7	+4
	LE.....	8/160	3	10/160	14	+11
Numbers	RE.....	10/200	3	10/200	3	+ -
	LE.....	5/100	3	10/200	3	+ -
CASE 65						
		$-4.00 = 20/15 -4$				
Letters	RE.....	10/100	20	10/50 -2	35	+15
	LE.....	9/100	35	10/70 -1	28	-7
Landolt	RE.....	10/175	5	10/125	8	+3
	LE.....	17/200	14	10/85	26	+12
E	RE.....	6/50 -3	41	10/60 -2	24	-17
	LE.....	18/200	17	10/60	41	+24
Numbers	RE.....	14/200 -1	6	10/70 +1	41	+35
	LE.....	17/200 -1	8	10/70	34	+26
CASE 66						
		$-3.50 = 20/20$				
Letters	RE.....	10/100	20	15/100 +1	42	+22
	LE.....	10/100	20	15/70 -1	51	+31
Landolt	RE.....	15/150	20	15/175	11	-9
	LE.....	15/175	16	15/150	20	+4
E	RE.....	20/120 -1	30	20/120	41	+11
	LE.....	20/160	29	20/120 +2	45	+16
Numbers	RE.....	20/200 -1	14	20/70 -1	60	+46
	LE.....	15/100 -1	27	20/70 +2	69	+42
CASE 67						
		$-9.50 = 2.00 \times 50 = 20/50$				
Letters	RE.....	4/70	5	10/100	20	+15
	LE.....	5/100	3	10/100 -1	14	+11
Landolt	RE.....	4/125	1	10/175	5	+4
	LE.....	4/85	1	10/200	3	+2
E	RE.....	3/80	1	10/120	14	+13
	LE.....	5/80	8	10/80 -1	24	+16
Numbers	RE.....	5/200	1	10/200	3	+2
	LE.....	4/70 -1	4	10/100 -1	14	+10
CASE 68						
		$-3.62 = -1.00 \times 10 = 20/15 -2$				
Letters	RE.....	10/200	3	10/70 -1	28	+25
	LE.....	7/100	10	10/70 -1	28	+18
Landolt	RE.....	12/125 -1	14	10/85	26	+12
	LE.....	12/125	20	10/70 -1	28	+8
E	RE.....	20/160 -1	24	10/80	29	+5
	LE.....	20/160 -1	24	10/60 -2	24	+ -
Numbers	RE.....	20/200 -1	14	10/70 +2	47	+33
	LE.....	20/200 -1	14	10/70 +1	41	+27
CASE 69						
		$-1.50 = -1.25 \times 15 = 20/20 +4$				
Letters	RE.....	20/200	20	20/200 +1	37	+17
	LE.....	17/100	34	15/200	11	-23
Landolt	RE.....	13/175	10	15/200	11	+1
	LE.....	18/175	14	20/175	23	+9
E	RE.....	20/160 -1	24	20/160	29	+5
	LE.....	20/160	29	20/120	41	+12
Numbers	RE.....	17/100 -1	34	20/200 +1	37	+3
	LE.....	20/200	20	20/200	20	+ -
CASE 70						
		$-1.25 = -0.50 \times 90 = 20/20 +4$				
Letters	RE.....	20/100 -1	37	20/70 +1	66	+29
	LE.....	20/100 -1	37	20/70 -1	60	+23
Landolt	RE.....	20/125	39	20/125	39	+ -
	LE.....	20/175	25	20/125	39	+14
E	RE.....	20/120 +2	46	20/120	41	-5
	LE.....	20/120	41	20/80	59	+18
Numbers	RE.....	20/200	20	20/70 -1	60	+40
	LE.....	20/200 +1	37	20/70 -1	60	+23

CHART IX.—Continued.

Results of Visual Acuity Tests and % Evaluation of Vision.

		Before Training	Visual Acuity %	After Training	Visual Acuity %	Difference %
CASE 70						
		Third Test				
Letters	RE.....	20/70 +1	69	.....	..	....
	LE.....	20/70 -1	59	.....	..	....
Landolt	RE.....	20/100 -1	37	.....	..	....
	LE.....	20/125 -1	30	.....	..	....
E	RE.....	20/80	59	.....	..	....
	LE.....	20/80 +2	62	.....	..	....
Numbers	RE.....	20/70	64	.....	..	....
	LE.....	20/70 +1	69	.....	..	....
CASE 71						
		$-6.50 = -0.50 \times 90 = 20/20 +3$		$-6.50 = -0.50 \times 90 = 20/20$		
Letters	RE.....	7/100 -1	8	15/100 -1	27	+19
	LE.....	7/70 -1	14	10/100	20	+6
Landolt	RE.....	8/175	1	10/200	3	+2
	LE.....	6/125	2	10/175 -1	3	+1
E	RE.....	10/80 -2	23	10/120	9	-14
	LE.....	6/120	3	10/160	15	+12
Numbers	RE.....	10/200	3	15/100	33	+30
	LE.....	10/200	3	10/200 +1	5	+2
CASE 72						
		$-2.25 = -0.75 \times 180 = 20/20$		$-2.50 = -0.50 \times 180 = 20/20$		
Letters	RE.....	20/200	20	20/200	20	+ -
	LE.....	20/200	20	20/200	20	+ -
Landolt	RE.....	20/200	20	15/200	11	-9
	LE.....	20/200	20	15/200	11	-9
E	RE.....	20/160	29	20/160 -1	24	-5
	LE.....	20/160 -1	24	20/120	41	+17
Numbers	RE.....	20/200 +1	37	20/200 +1	37	+ -
	LE.....	20/200	20	20/200	20	+ -
CASE 74						
		$-2.50 = -0.25 \times 180 = 20/20 -1$		$-1.75 = -0.52 \times 5 = 20/20$		
Letters	RE.....	10/100 +1	37	20/200	20	-17
	LE.....	15/100 -1	27	20/70 -1	60	+33
Landolt	RE.....	15/200	11	20/175	25	+14
	LE.....	15/175	16	20/150	31	+15
E	RE.....	10/60 -2	24	20/120	41	+17
	LE.....	15/80 -2	35	20/80	59	+24
Numbers	RE.....	15/100 -1	27	20/200 +1	37	+10
	LE.....	15/100 -1	27	20/100 -1	37	+10
CASE 75						
		$-4.00 = -3.00 \times 180 = 20/20$		$-5.50 = -2.50 \times 180 = 20/30 +1$		
Letters	RE.....	5/100	3	10/100 -1	14	+11
	LE.....	6/200	1	10/200	3	+2
Landolt	RE.....	6/175 -1	1	10/200	3	+2
	LE.....	5/175	1	6/200	1	+ -
E	RE.....	10/160 -1	4	10/80 -1	24	+20
	LE.....	5/160	1	10/160	7	+6
Numbers	RE.....	10/200 -1	1	8/200	3	+2
	LE.....	6/200 -1	1	1/200	3	+2
CASE 76						
		$-0.50 = -0.25 \times 135 = 20/20$		$-0.75 = 20/15 -4$		
Letters	RE.....	20/30	92	20/40 +2	87	-5
	LE.....	20/40 +3	89	20/40	84	-5
Landolt	RE.....	20/85	56	20/85	56	+ -
	LE.....	20/85	56	20/85	56	+ -
E	RE.....	20/30 +1	93	20/40 -1	82	-11
	LE.....	20/40	84	20/40 +1	85	+1
Numbers	RE.....	20/30 -2	90	20/40 -3	79	-11
	LE.....	20/40 -3	79	20/40 -2	81	+2
CASE 77						
		$-0.50 \times 90 = 20/20$		$-0.50 = 20/15$		
Letters	RE.....	20/40 +3	89	20/70 +1	66	-23
	LE.....	20/40 -2	81	20/40 -2	81	+ -
Landolt	RE.....	20/45	80	20/85 +2	60	-20
	LE.....	20/60 -1	68	20/70	64	-4
E	RE.....	20/40 -2	61	20/60 +3	74	-7
	LE.....	20/60	70	20/40	89	+19
Numbers	RE.....	20/30 -3	88	20/70 +1	66	-22
	LE.....	20/40 -2	81	20/70	64	-17
CASE 78						
		$-6.25 = 20/20$		$-5.50 = -0.75 \times 180 = 20/25$		
Letters	RE.....	6/100 -1	3	20/100 +1	54	+51
	LE.....	8/100	13	15/100	33	+20
Landolt	RE.....	6/150	1	20/175	25	+24
	LE.....	6/125 -1	3	10/125	13	+10
E	RE.....	6/80	7	20/80 +2	62	+55
	LE.....	10/160	7	10/80 -2	23	+16
Numbers	RE.....	8/100	13	20/100	49	+36
	LE.....	7/100 -1	6	10/100 +1	37	+31

CHART IX.—Continued.

Results of Visual Acuity Tests and % Evaluation of Vision.

		Before Training	Visual Acuity %	After Training	Visual Acuity %	Difference %
CASE 79						
Letters	RE.....	-1.75 = -0.25 × 180 = 20/20		-1.50 = -0.50 × 180 = 20/20		
	LE.....	20/100	49	20/40	84	+35
Landolt	RE.....	20/100 +1	54	20/40 -2	81	+27
	LE.....	20/175 -1	23	20/70 -1	60	+37
E	RE.....	20/125	39	20/200	20	-19
	LE.....	20/80	59	20/20	100	+41
Numbers	RE.....	20/80	59	20/80	59	+ -
	LE.....	20/200 -1	37	20/60 -1	68	+31
		20/50 -2	73	20/60 -1	68	-5
CASE 79						
		Third Test				
Letters	RE.....	20/200	20	.....	..	....
	LE.....	15/200	11	.....	..	....
Landolt	RE.....	20/175 -1	23	.....	..	....
	LE.....	20/175	25	.....	..	....
E	RE.....	10/120 +1	45	.....	..	....
	LE.....	20/80 +2	62	.....	..	....
Numbers	RE.....	18/200	17	.....	..	....
	LE.....	20/100 -1	37	.....	..	....
CASE 81						
Letters	RE.....	-2.00 = 20/15		-2.00 = 20/15		
	LE.....	20/50	76	20/40 +1	86	+10
Landolt	RE.....	20/70	64	20/70 +1	66	+2
	LE.....	20/100	49	20/150	31	-18
E	RE.....	20/150 +1	40	20/150	31	-9
	LE.....	20/80	59	20/40	84	+25
Numbers	RE.....	20/80 -2	56	20/80	59	+3
	LE.....	20/70	64	20/50 -2	73	+9
		20/100 +1	54	20/100	49	-5
CASE 83						
Letters	RE.....	-3.50 = 20/20		-3.25 = 20/20		
	LE.....	20/40 -1	82	15/100 -1	27	-55
Landolt	RE.....	20/200	20	15/100 +1	39	+19
	LE.....	20/85	61	15/125 -1	23	-38
E	RE.....	20/125	39	15/175	16	-23
	LE.....	20/80	59	15/120	23	-36
Numbers	RE.....	20/120	41	15/80 +2	64	+23
	LE.....	20/50	76	15/200 -1	7	-69
		20/50	76	15/200 -1	7	-69
CASE 84						
Letters	RE.....	-0.75 = 20/20		-0.50 = 20/20		
	LE.....	20/30	92	20/20 -2	90	-2
Landolt	RE.....	20/30	92	20/150	76	-16
	LE.....	20/50	76	20/70 -1	60	-16
E	RE.....	20/40	84	20/70 -1	60	-24
	LE.....	20/30	92	20/40	84	-8
Numbers	RE.....	20/25	96	20/30 +2	95	-1
	LE.....	20/30	92	20/40 -1	82	-10
		20/30	92	20/40	84	-8
CASE 85						
Letters	RE.....	-3.25 = 20/20		-2.00 = 20/20		
	LE.....	20/200	20	10/100 -1	14	-6
Landolt	RE.....	20/100	49	20/20 -1	60	+11
	LE.....	15/200	11	10/100 -1	14	+3
E	RE.....	18/200	17	20/125 -1	23	+6
	LE.....	20/200 +1	57	10/80 -1	24	-33
Numbers	RE.....	20/120	41	20/80	59	+18
	LE.....	10/200	3	10/100 +1	37	+34
		20/100	49	20/100 +1	54	+5
CASE 86						
Letters	RE.....	-5.50 = -0.50 × 180 = 20/20		-5.25 = 0.50 × 180 = 20/20		
	LE.....	8/200	1	10/200	3	+2
Landolt	RE.....	10/200	3	10/200	3	+ -
	LE.....	5/200	1	10/200	3	+2
E	RE.....	6/200	1	10/175 -1	4	+3
	LE.....	7/200	1	10/160 -1	5	+4
Numbers	RE.....	7/200	1	10/160 -1	5	+4
	LE.....	6/200	1	10/200 -1	1	+ -
		7/200	1	10/200	3	+2
CASE 87						
Letters	RE.....	-3.50 = -0.25 × 90 = 20/20		-3.75 = 20/15		
	LE.....	9/200	1	10/200	3	+2
Landolt	RE.....	5/70 -1	5	10/100 -1	14	+9
	LE.....	6/200	1	5/200	1	+ -
E	RE.....	5/200	1	10/175	5	+4
	LE.....	11/160 -1	5	10/200	3	-2
Numbers	RE.....	12/160	5	10/120	15	+10
	LE.....	10/200 -1	1	10/200 +1	14	+13
		10/200 -1	1	10/200 +1	14	+13

CHART IX.—Continued.

Results of Visual Acuity Tests and % Evaluation of Vision.

		Before Training	Visual Acuity %	After Training	Visual Acuity %	Difference %
CASE 88		$-3.00 = -0.75 \times 180 = 20/20 +4$		$-2.50 = -0.62 \times 180 = 20/20 +4$		
Letters	RE.....	15/200	11	15/100	33	+22
	LE.....	10/100 -1	14	20/100	49	+35
Landolt	RE.....	7/125	5	10/200	3	-2
	LE.....	10/175	5	20/200	20	+15
E	RE.....	10/160	14	15/160	10	-4
	LE.....	10/120	15	20/120 -1	34	+19
Numbers	RE.....	10/200	3	15/200 +1	15	+12
	LE.....	10/70	34	20/100 -1	37	+3
CASE 89		$-2.50 = 20/15 -1$		$-2.75 = -0.25 \times 180 = 20/15$		
Letters	RE.....	15/200	11	20/40 -2	81	+70
	LE.....	15/100 +1	37	20/50	76	+39
Landolt	RE.....	10/175	5	20/70 -1	60	+55
	LE.....	10/175 -1	4	20/85	56	+52
E	RE.....	20/200	20	20/50 -2	73	+53
	LE.....	15/200	11	20/40 -3	79	+68
Numbers	RE.....	10/70	34	20/50 -3	71	+37
	LE.....	10/200 +1	12	20/50 -2	73	+61
CASE 90		$-4.25 = 20/20$		$-2.00 = -0.50 \times 90 = 20/15$		
Letters	RE.....	10/200	3	10/200	3	+ -
	LE.....	15/100	33	20/200	20	-13
Landolt	RE.....	6/200	5	10/175 -1	4	-1
	LE.....	10/175	5	20/100	49	+44
E	RE.....	12/160	27	10/120	14	-13
	LE.....	15/80 -2	27	20/80	58	+31
Numbers	RE.....	10/200	3	10/200	3	+ -
	LE.....	15/100 -1	27	20/100 -1	37	+10
CASE 90		Third Test				
Letters	RE.....	12/200	8	.....	..	....
	LE.....	17/100	34	.....	..	....
Landolt	RE.....	10/175	5	.....	..	....
	LE.....	10/175	5	.....	..	....
E	RE.....	10/160	7	.....	..	....
	LE.....	20/200	20	.....	..	....
Numbers	RE.....	12/200	8	.....	..	....
	LE.....	20/200	20	.....	..	....
CASE 91		$-4.25 = 20/20$		$-4.50 = 20/20$		
Letters	RE.....	10/200	3	20/100	49	+46
	LE.....	10/200	3	10/100	20	+17
Landolt	RE.....	5/100	3	15/200	11	+8
	LE.....	5/100	3	12/200	8	+5
E	RE.....	10/120	14	20/120 -1	34	+20
	LE.....	10/120 -1	11	10/120	14	+3
Numbers	RE.....	20/200	20	20/100	49	+29
	LE.....	20/200 +1	37	10/200	3	-34
CASE 93		$-4.25 = -0.25 \times 90 = 20/20$		$-4.00 = -0.25 \times 90 = 20/20$		
Letters	RE.....	8/100 -1	8	20/200	20	+12
	LE.....	12/100 -1	23	5/50	20	-3
Landolt	RE.....	13/200	9	5/85	5	-4
	LE.....	13/175	10	5/100 -1	1	-9
E	RE.....	13/120 +1	35	10/80 -1	24	-11
	LE.....	10/200 +1	5	10/120 +1	17	+12
Numbers	RE.....	5/100	3	12/200	8	+5
	LE.....	10/200	3	10/200 +1	14	+11
CASE 94		$-2.50 = -0.50 \times 180 = 20/15$		$-2.25 = 20/20$		
Letters	RE.....	20/200	20	20/70	64	+44
	LE.....	20/200	20	20/70 -1	60	+40
Landolt	RE.....	12/200	8	20/125	39	+31
	LE.....	10/85	26	20/85	56	+30
E	RE.....	15/200	11	20/60 +3	74	+63
	LE.....	20/120 -2	28	20/60 +2	72	+44
Numbers	RE.....	15/200 -1	7	20/100 -1	37	+30
	LE.....	20/100 -1	37	20/100 -1	37	+ -
CASE 95		$-1.50 = -0.50 \times 90 = 20/30 +4$		$-2.00 = -0.25 \times 90 = 20/30$		
Letters	RE.....	20/200	20	25/40 +1	86	+66
	LE.....	10/70 -1	28	20/50 +1	78	+50
Landolt	RE.....	10/125 -1	10	20/125	39	+29
	LE.....	10/125 -1	10	20/150	31	+21
E	RE.....	20/160	29	20/50	76	+47
	LE.....	10/60	41	20/60 +1	71	+30
Numbers	RE.....	15/200	11	20/40 +1	86	+75
	LE.....	10/100 -1	14	20/70 -1	60	+46

CHART IX.—Continued.
Results of Visual Acuity Tests and % Evaluation of Vision.

		Before Training	Visual Acuity %	After Training	Visual Acuity %	Difference %
CASE 96						
		$-1.25 = -0.50 \times 20 = 20/20$		$-1.50 = -0.50 \times 135 = 20/20 + 2$		
Letters	RE.....	20/70	64	20/70	64	+ -
	LE.....	20/100	49	20/50	77	+28
Landolt	RE.....	20/175 -1	23	20/100	49	+26
	LE.....	20/200	20	20/85	56	+36
E	RE.....	20/60 +2	72	20/60 +3	74	+2
	LE.....	20/80	59	20/50	77	+18
Numbers	RE.....	20/70 +2	69	20/40 -2	81	+12
	LE.....	20/100	49	20/40 -3	79	+30
CASE 97						
		$-1.00 = -0.25 \times 90 = 20/15$		$-1.00 = -0.25 \times 180 = 20/15$		
Letters	RE.....	20/100	49	20/20 -3	97	+48
	LE.....	20/100 +1	54	20/20 -4	96	+42
Landolt	RE.....	20/175	25	20/85	56	+31
	LE.....	20/175	25	20/60	70	+45
E	RE.....	20/80	59	20/40	84	+25
	LE.....	20/80	59	20/30	97	+38
Numbers	RE.....	20/200 +1	37	20/30 -2	90	+53
	LE.....	20/100 -1	37	20/40 +2	87	+50
CASE 97						
		Third Test				
Letters	RE.....	20/30	92	.....	..	....
	LE.....	20/70	64	.....	..	....
Landolt	RE.....	20/70 -1	60	.....	..	....
	LE.....	20/100 +1	54	.....	..	....
E	RE.....	20/50 +1	78	.....	..	....
	LE.....	20/60 +1	70	.....	..	....
Numbers	RE.....	20/100	49	.....	..	....
	LE.....	20/70	64	.....	..	....
CASE 98						
		$-0.50 \times 180 = 20/20$		$-2.75 = -0.75 \times 180 = 20/20$		
Letters	RE.....	20/30	92	20/20 +1	100	+8
	LE.....	10/200	3	10/100 +1	37	+34
Landolt	RE.....	20/50 -1	75	20/30	92	+17
	LE.....	8/200	1	10/125	13	+12
E	RE.....	20/30 +2	95	20/20	100	+5
	LE.....	15/200	11	10/50 -2	27	+16
Numbers	RE.....	20/30	92	20/20 -2	98	+6
	LE.....	8/200	3	10/100 +1	37	+34
CASE 99						
		$-0.50 = -0.50 \times 175 = 20/20$		$-0.75 = -0.25 \times 180 = 20/15 -1$		
Letters	RE.....	20/50	77	20/30 +2	95	+18
	LE.....	20/50	77	20/20 -3	97	+20
Landolt	RE.....	20/70	64	20/45 +1	82	+18
	LE.....	20/70	64	20/40 -1	82	+18
E	RE.....	20/40 -1	82	20/30 +2	95	+13
	LE.....	20/30	92	20/30 -3	88	-4
Numbers	RE.....	20/30	92	20/40 -2	81	-11
	LE.....	20/30 -3	88	20/40 -2	81	-7
CASE 99						
		Third Test				
Letters	RE.....	20/40	84	.....	..	....
	LE.....	20/40 +2	86	.....	..	....
Landolt	RE.....	20/60	70	.....	..	....
	LE.....	20/50	76	.....	..	....
E	RE.....	20/30	92	.....	..	....
	LE.....	20/40	84	.....	..	....
Numbers	RE.....	20/40 +3	89	.....	..	....
	LE.....	20/40 -1	82	.....	..	....
CASE 100						
		$-0.37 = 20/15 -3$		$-0.37 = -0.25 \times 25 = 20/20$		
Letters	RE.....	20/40 +2	87	20/30 -2	90	+3
	LE.....	20/30	92	20/20 -2	98	+6
Landolt	RE.....	20/60 +1	72	20/50	77	+5
	LE.....	20/50 -1	75	20/45	80	+5
E	RE.....	20/30 +3	96	20/30 -3	88	-8
	LE.....	20/25	96	20/30 -1	91	-5
Numbers	RE.....	20/30 -2	90	20/40	84	-6
	LE.....	20/30 +1	93	20/30 -2	90	-3
CASE 101						
		$-2.25 = -0.50 \times 95 = 20/15 -4$		$-2.75 = -0.50 \times 85 = 20/20 +3$		
Letters	RE.....	20/200	20	20/200	20	+ -
	LE.....	10/100	20	15/200	11	-9
Landolt	RE.....	20/200	20	15/200	11	-9
	LE.....	10/175	5	15/200	11	+6
E	RE.....	20/200	20	20/120 +1	45	+25
	LE.....	10/160 -1	4	15/120	29	+25
Numbers	RE.....	20/200	20	20/200	20	+ -
	LE.....	7/70	20	15/200	11	-9
CASE 103						
		$-4.00 = -0.75 \times 180 = 20/20$		$-4.50 = -0.50 \times 175 = 20/20 -2$		
Letters	RE.....	10/200	3	20/70 -1	60	+57
	LE.....	7/100	9	10/70 -1	28	+19
Landolt	RE.....	7/200	1	20/175	25	+24
	LE.....	7/175	1	10/100 -1	14	+13
E	RE.....	7/120	5	20/120	41	+36
	LE.....	10/160 +1	15	10/50	49	+34
Numbers	RE.....	10/200 -1	1	20/100	49	+48
	LE.....	7/200 +1	1	10/70 +2	46	+45

CHART IX.—Continued.
Results of Visual Acuity Tests and % Evaluation of Vision.

		Before Training	Visual Acuity %	After Training	Visual Acuity %	Difference %
CASE 104		$-2.25 = -0.37 \times 90 = 20/15 -3$				
Letters	RE.....					
	LE.....	15/200 +1	12	20/70 -1	60	+48
Landolt	RE.....					
	LE.....	15/200	11	20/150	31	+20
E	RE.....					
	LE.....	15/200	11	20/120 -1	34	+23
Numbers	RE.....					
	LE.....	15/200	11	20/100 +1	54	+43
CASE 105		$-1.25 = -0.75 \times 180 = 20/20$				
Letters	RE.....	20/100	49	20/70 -1	60	+11
	LE.....	20/50	77	20/70 -1	60	-17
Landolt	RE.....	20/175	25	20/100	49	+24
	LE.....	20/85	56	20/125	39	-17
E	RE.....	20/160 +1	24	20/50 +2	80	+56
	LE.....	20/60	70	20/60 +3	74	+4
Numbers	RE.....	20/100 -1	37	20/50 +1	78	+41
	LE.....	20/40 -3	80	20/100 -1	37	-43
CASE 106		$-2.75 = 20/15 -3$				
Letters	RE.....	19/200	19	20/100 -1	37	+18
	LE.....	11/100	22	15/100 +1	39	+17
Landolt	RE.....	15/175	15	20/125	39	+24
	LE.....	10/175	4	15/100	33	+29
E	RE.....	20/200	20	20/120 +1	45	+25
	LE.....	10/80 -2	23	15/80 -2	40	+17
Numbers	RE.....	20/200 -1	14	20/200	20	+6
	LE.....	12/200	8	20/100	49	+41
CASE 107		$-1.75 = -0.50 \times 180 = 20/20$				
Letters	RE.....	20/200	20	20/70 -1	60	+40
	LE.....	20/200	20	20/70 -1	60	+40
Landolt	RE.....	10/100 -1	14	20/150	31	+17
	LE.....	10/100 -1	14	20/150 +1	42	+28
E	RE.....	20/200 +1	37	20/80	59	+22
	LE.....	20/100	49	20/80 -2	56	+7
Numbers	RE.....	10/200 +1	6	20/100 -1	37	+31
	LE.....	10/100 +2	27	20/70 -2	54	+27
CASE 107		Third Test				
Letters	RE.....	20/70 -2	54	.....	..	....
	LE.....	20/70	64	.....	..	....
Landolt	RE.....	20/125 -1	30	.....	..	....
	LE.....	20/85 -1	55	.....	..	....
E	RE.....	20/60 -4	67	.....	..	....
	LE.....	20/50 -1	72	.....	..	....
Numbers	RE.....	20/70 -3	52	.....	..	....
	LE.....	20/70 -1	59	.....	..	....
CASE 108		$-0.37 = 20/15$				
Letters	RE.....	20/20 -1	99	20/30 -2	90	-9
	LE.....	20/30 +3	96	20/40 -3	79	-17
Landolt	RE.....	20/40 +1	86	20/45	80	-6
	LE.....	20/45	80	20/60	70	-10
E	RE.....	20/20 +3	100	20/25	96	-4
	LE.....	20/25 +2	97	20/40	84	-13
Numbers	RE.....	20/20 -3	97	20/30	92	-5
	LE.....	20/30 -2	90	20/70 +1	66	-24
CASE 109		$-4.75 = 20/20 -1$				
Letters	RE.....	10/200	3	10/100	20	+17
	LE.....	20/15 -2	100	20/15 -4	100	+1
Landolt	RE.....	6/125	4	10/125	13	+9
	LE.....	20/25 -3	92	20/30	92	+1
E	RE.....	10/200	3	10/80	29	+26
	LE.....	20/15 -2	100	20/15	100	+1
Numbers	RE.....	10/200 -1	1	10/100	20	+19
	LE.....	20/20 -1	99	20/20	100	+1
CASE 110		$-3.00 = 20/20$				
Letters	RE.....	10/100 -1	14	20/200	20	+6
	LE.....	10/100 -1	14	15/200 +1	12	-2
Landolt	RE.....	12/200	8	15/200	11	+3
	LE.....	10/175 -1	4	15/175	16	+12
E	RE.....	10/120 -1	11	20/160	38	+27
	LE.....	10/120 -1	11	15/120	29	+18
Numbers	RE.....	10/70 -1	28	20/200 +1	37	+9
	LE.....	7/70 -1	12	15/200 +1	12	+1
CASE 110		Third Test				
Letters	RE.....	15/200	11	.....	..	....
	LE.....	15/200	11	.....	..	....
Landolt	RE.....	10/200	3	.....	..	....
	LE.....	12/200	8	.....	..	....
E	RE.....	20/200	20	.....	..	....
	LE.....	15/200	11	.....	..	....
Numbers	RE.....	9/100	17	.....	..	....
	LE.....	10/200	3	.....	..	....

CHART IX.—Continued.
Results of Visual Acuity Tests and % Evaluation of Vision.

		Before Training	Visual Acuity %	After Training	Visual Acuity %	Difference %
CASE 111		$-2.25 = -0.37 \times 175 = 20/15 -3$				
Letters	RE.....					
	LE.....	15/100	33	20/100	49	+16
Landolt	RE.....					
	LE.....	15/200	11	10/125	13	+2
E	RE.....					
	LE.....	15/200	29	20/160 -1	24	-5
Numbers	RE.....					
	LE.....	15/100 -1	27	13/200	9	-18
CASE 112		$-2.50 = 20/20 +3$				
Letters	RE.....	15/100	33	20/200	20	-13
	LE.....	20/100 +1	54	20/70	64	+10
Landolt	RE.....	12/175	10	20/150	32	+22
	LE.....	20/100	49	20/175	25	-24
E	RE.....	15/120	29	20/160 +1	38	+9
	LE.....	20/80 -2	56	20/80 +1	60	+4
Numbers	RE.....	15/200	11	20/200	20	+9
	LE.....	20/70	64	20/70 -1	60	-4
CASE 121		$-3.25 = -0.25 \times 90 = 20/20$				
Letters	RE.....	9/200	1	15/200	11	+10
	LE.....	10/200	3	15/200	11	+8
Landolt	RE.....	8/175	2	15/200	11	+9
	LE.....	8/175	2	13/200	9	+7
E	RE.....	8/160 +1	6	15/160 -1	14	+8
	LE.....	10/160	7	15/200	11	+4
Numbers	RE.....	8/200	1	15/200	11	+10
	LE.....	10/200	3	15/200	11	+8
CASE 122		$-4.00 = 20/20$				
Letters	RE.....	10/200	3	20/200 +1	37	+34
	LE.....	10/200	3	15/200	11	+8
Landolt	RE.....	5/150	1	12/200	8	+7
	LE.....	5/175	1	10/175	5	+4
E	RE.....	10/200	3	20/200	20	+17
	LE.....	5/200	1	10/160	7	+6
Numbers	RE.....	10/200	3	20/200 -1	14	+11
	LE.....	5/200	1	10/100 -1	14	+13
CASE 124		$-1.50 = 20/20$				
Letters	RE.....	20/70	64	20/40 -1	82	+18
	LE.....	20/70	64	20/40	84	+20
Landolt	RE.....	10/175 -1	4	20/100	49	+45
	LE.....	10/175	5	20/100	49	+44
E	RE.....	20/120 -1	34	20/40 +3	89	+55
	LE.....	20/120	41	20/30 -2	90	+49
Numbers	RE.....	20/70 -1	60	20/50 -1	75	+15
	LE.....	20/70 -1	60	20/40 -1	82	+22
CASE 126		$-1.25 = -0.50 \times 180 = 20/20$				
Letters	RE.....	20/70 -2	54	20/30	92	+38
	LE.....	20/70 -1	60	20/40 +2	87	+27
Landolt	RE.....	20/200	20	20/60	70	+50
	LE.....	15/125	27	20/85	56	+29
E	RE.....	20/80	59	20/40 +3	89	+30
	LE.....	20/80 -3	52	20/50 -2	73	+21
Numbers	RE.....	20/70 -1	60	20/40 -1	82	+22
	LE.....	20/200	20	20/70 +2	69	+49
CASE 127		$-3.25 = -0.25 \times 90 = 20/15$				
Letters	RE.....	20/200	20	20/50 -1	75	+55
	LE.....	20/100 -1	37	20/100	49	+12
Landolt	RE.....	10/125	13	20/125	39	+26
	LE.....	10/125 -1	10	20/100 -1	37	+27
E	RE.....	20/160	29	20/80 -2	56	+27
	LE.....	20/120	41	20/80	59	+18
Numbers	RE.....	20/100 -1	37	20/100	49	+12
	LE.....	20/100	49	20/100	49	+1
CASE 127		Third Test				
Letters	RE.....	10/70	34	.....	..	....
	LE.....	20/200	20	.....	..	....
Landolt	RE.....	20/125	39	.....	..	....
	LE.....	20/175	25	.....	..	....
E	RE.....	20/80 -2	50	.....	..	....
	LE.....	20/120	41	.....	..	....
Numbers	RE.....	20/200	20	.....	..	....
	LE.....	20/100 -1	37	.....	..	....
CASE 131		$-2.00 = -0.25 \times 180 = 20/15$				
Letters	RE.....	20/200	20	20/100 -1	37	+17
	LE.....	20/200	20	20/200	20	+1
Landolt	RE.....	20/200	20	15/200	11	-9
	LE.....	20/175 -1	23	15/200	11	-12
E	RE.....	20/200	20	20/120	41	+21
	LE.....	20/160	29	20/80	59	+30
Numbers	RE.....	20/200	20	20/200 -1	14	-6
	LE.....	20/200	20	20/100 -1	37	+17

visual acuity of 3, and is theoretically capable of a 97-point increase in the percentage visual acuity, whereas one with a low-grade myopia whose uncorrected vision is 20/30 has a percentage visual acuity of 92 and is susceptible of an improvement of only 8 points in the percentage visual acuity. This statistical fallacy appears to be clearly reflected in the results. Thus, in groups I and II, where the greatest improvement in the percentage visual acuity was noted, the myopia was most severe, the initial average visual acuity of both eyes being 27.3 and 23.2, respectively, in the two groups. In group III, where there was no essential change, the myopia was less severe, the average percentage visual acuity being 40. In group IV, where there was an actual, although not significant, loss in the percentage visual acuity, the average myopia was of low degree and the average percentage visual acuity before exercises was 75.1. In short, the lower the initial percentage visual acuity, the more room there was for improvement, and the more likely improvement would result from any educational process. The higher initial percentage visual acuity, the less room there was for improvement and the less chance there would be for an educational procedure to produce improvement.

The first two points, the variation in visual acuity of myopic individuals with the same refractive error, and the swing in the same individual on different charts, in themselves disclose a margin of error in subjective testing sufficient to account for the average improvement observed in groups I and II. The third point, the weighting of the scales in favor of an improvement in those with high myopia, may also be a factor in the improvements shown by the patients in these two groups.

However, the fact remains that approximately 60 percent of the patients did show moderate to slight improvement

in the percentage visual acuity after the visual training. The essential question is whether this low-grade improvement (groups I and II) and the occasional more spectacular individual improvement (cases 3 and 4) are to be explained entirely on the basis of individual fluctuations and a statistical presentation or is any credit to be given to the visual training to which the patients were subjected?

I have already pointed out that the average degree of improvement noted in groups I and II was within the limit of error of subjective testing and the individual interpretation of a blurred myopic visual image. However, it was the general impression of the examining physicians that after the eye exercises a great number of the patients were more careful in the interpretation of their visual impressions. Just how far careful study of a blurred visual image will result in an improvement in the subjective visual acuity can readily be demonstrated on any aphakic individual of ordinary intelligence. In an aphakic individual with 20/15 corrected vision in each eye, the introduction of +1.00 spheres before his correction will immediately reduce the visual acuity to about 20/40. However, with a few minutes' careful study of an unknown letter chart or a broken-circle chart, such an individual will be able to decipher the 20/20 line accurately. Similarly, the introduction of +2.00 spheres, giving a false myopia of -2.00 diopters, reduces vision to 20/100, but after a few minutes' study the patient can identify symbols on the 20/50 line. In short, the subjective determination of the vision of a myopic person on the Snellen chart is, within certain limits, a test of the individual's ability to interpret correctly the blurred visual impression received on the retina. In so far as any form of visual education aids an individual to the maximum utilization and correct interpretation

of a blurred retinal image, such procedures are of value. There are obviously definite limits within which such education is possible. For example, this visual-training program appears to be of little value to individuals unable to pass the visual requirements of the United States Naval Academy. There were nine such individuals in this group of trainees and only in one instance (4) was the improvement sufficient to allow the candidate to pass the Naval Academy examinations, although in one other case (3) the candidate came close to the passing level. However, the more the initial interpretation of a visual sensation is faulty, the more unstable or careless the individual is in his visual habits, the more room and hope there is for an improvement as a result of education.

The different examining physicians were impressed by a psychologic improvement in a number of patients. Some patients while exhibiting no material change in their visual acuity, were nevertheless convinced they saw better and that they used their eyes with greater satisfaction to themselves. There were no psychiatric examinations on these patients, but the examining physicians all agreed that this psychologic improvement was more noticeable in those individuals who appeared somewhat emotionally unstable. It should therefore be conceded that the visual training, in so far as it produced a psychologic change in the patients toward their visual handicap, was of benefit to the patients.

Therefore, while it is admitted that within narrow limits there may be some educational merit to this visual training, and that in impressionable individuals there may be some beneficial psychologic change, the results of this study give little comfort to the advocates of this method of treating myopia. The visual gains resulting from this training were small and not

constantly maintained. The visual training had no effect on the basic myopia as determined by retinoscopy. The results of this experiment indicate that the visual training is of no value in curing myopia.

SUMMARY AND CONCLUSIONS

A series of 103 myopic individuals were selected from a total of 130 applicants. The uncorrected visual acuity of these patients was recorded, a cycloplegic instilled, and the retinoscopic and static refractions determined. These 103 myopic persons were then returned to a group of optometrists and psychologists for a course of visual training designed to improve their uncorrected vision. At the end of this visual training the patients were again examined to determine what change had occurred in their uncorrected vision. It was found that 30 of these patients, or 29 percent, showed a low-grade improvement on all charts. This improvement averaged an increase of 27 points in the percentage visual acuity. A second group of 31 patients, or 30 percent, did not show a consistent improvement on all four charts but did show an overall improvement in both eyes which averaged 14.7 points increase in the percentage visual acuity. As far as could be determined the improvement in these two groups was not consistently maintained. A third group of 32 patients, or 31 percent, showed practically no change in the percentage visual acuity. A fourth group of 10 patients, or 9 percent, showed a decrease in the percentage visual acuity of 10.8 points.

The changes in the percentage visual acuity noted was found to lie within the limits of error of subjective testing of the visual acuity. Also the estimating of change on the basis of percentage visual acuity weights the scales in favor of improvement in those who have high myopia.

The maximum average increase noted in group I was between one and three lines improvement in the Snellen scale. It was believed by the examiners that education in the correct interpretation of a blurred visual image was the chief factor in the improvement noted in this group. It was further believed that the exercises produced a beneficial psychologic reaction in certain patients toward their visual handicap, regardless of

whether an actual improvement in visual acuity had occurred.

With the possible exceptions of educating some patients to interpret blurred retinal images more carefully and of convincing some others that they could see better even though there was no actual improvement, this study indicates that the visual training used on these patients was of no value for the treatment of myopia.

EYE CONDITIONS AMONG CHILDREN OF PREMATURE, FULL-TERM, AND HYPERMATURE BIRTH*

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The frequent appearance of amblyopic school children whose history records premature birth suggested the possibility that such children's vision might mature more slowly than that of others. A preliminary study¹ of 100 poor readers revealed a markedly higher incidence of premature births than is usually encountered in the general population. Furthermore, 31 percent of the children born prematurely were found to have defective vision.

Since then 619 children have been studied, of whom 155 were born before the completion of the normal term of pregnancy or weighed $5\frac{1}{2}$ pounds or less at birth.[†] They were compared with 439 children who were born at full term or whose birth weight was more than $5\frac{1}{2}$ pounds. Both of these groups were compared with another composed of 25 children born during or after the tenth calendar month of pregnancy. The age range in all groups was from 5 through 17 years. The writer's primary interest in

the subject centered on the educational implications for children from first through twelfth grade and only those whose ages corresponded to this range were admitted to the study.

All of the children were given complete eye examination, and measurements of visual acuity, refraction, and muscular imbalance were taken. The visual-acuity and muscular-imbalance measurements were made with the refractive correction in use. In addition other physical defects and diseases observed during eye examination were recorded.

Comparison of the groups without reference to age revealed 28 percent *more* children with vision of 20/30 or less among those born prematurely. The frequency difference was the same for each eye but for both eyes together the difference was 24 percent. The same group presented 4 percent *less* hypermetropia in the right eye and 12 percent *less* in the left eye, but displayed 9 percent *more* myopia in the right eye and 8 percent *more* in the left eye. The groups showed little or no difference in the incidence of either hypermetropic or myopic astigmatism. They also displayed no difference in the

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† The children considered premature in time were 8.0 months of term or less.

incidence of either esophoria or exophoria of five prism diopters or more in distance vision but exhibited 4 percent *less* esophoria and 1 percent *less* exophoria in near vision.[†]

The central tendency of the examination results were studied in terms of median.[§] The premature group exhibited a median visual acuity (with correction) of one Snellen line *poorer* vision in the left eye only. No other important differences in the medians were noted in any of the fields of investigation.

All of the cases of both premature and full-term birth were next distributed according to age. This necessarily provided smaller numbers of cases at each age level and limited the study to that extent. However, age comparisons have shown interesting trends which are worth considering.

The frequency of vision of 20/30 or less was found to be higher in the premature group at *all* ages, for each and for both eyes together. There was a *higher* incidence of low vision in the left eye among the premature cases at the 6-, 7-, and 12-year levels, and at the 6-, 7-, 9-, 10-, 11-, 14-, and 16-year levels among the full term cases. The premature group exhibited a *higher* frequency of low vision in the right eye at 17 years. It appears that there is a general tendency toward more frequent low vision in the left eye in both groups, but this tendency was greater among those who were not premature. With age, both groups dis-

played some tendency toward a decrease in the frequency of hypermetropia and an increase in that of myopia in both spherical and astigmatic refraction. The premature group presented a general tendency toward a *lower* frequency of hypermetropic astigmatism in each eye at the ages from five through eight years. The frequency of exophoria in distance vision, among the premature cases, was *lower* until the age of nine years. From 10 to 13 it showed less difference from that of the full-term group, but at the age of 14 it rose sharply above their level and tended to remain elevated through age 17. The frequency of exophoria in near vision tended to increase with age in both groups after the eighth year. The premature children exhibited a tendency toward a greater incidence than did the others. No marked difference between the frequencies of esophoria in distance vision was noted, but the premature group showed a consistently *lower* frequency of esophoria in near vision.

The study of central tendency by age levels revealed a consistently *lower* median visual acuity through the ninth year in the premature group and a median visual acuity of one Snellen line *poorer* vision in the left eye in each group at the sixth year. The median myopia tended slightly to show an *increase* from the fifteenth through the seventeenth year among those prematurely born. Measurements of muscular imbalances were distributed on either side of the zero or orthophoric point, with exophoria on one side and esophoria on the other. This was done so as to take into account all the cases instead of studying exophoric and esophoric cases separately without regard to the cases of orthophoria. This seemed wise since measurements of muscular imbalances are commonly taken in degrees or prism diopters of deviation from the orthophoric or mid point on the whole

[†] Muscular-imbalance measurements for distance vision were taken at 20 feet. For near vision the test distance was determined by the body build of the child, the reading or near distance being such that the arm formed a right angle with the forearm while the book was being held.

[§] The median is the position in a distribution where the middle case falls. It is superior to the arithmetic mean (average) because one or two abnormally high or low scores do not distort the expression of central tendency. For this reason a truer indication is provided.

scale from exophoria through orthophoria to esophoria or vice versa.

The medians in the two groups differed little in tests at 20 feet, both falling either in the orthophoric range or in one of the low exophoric intervals. No esophoric medians appeared in either group in distance or in near vision. The medians for near vision were in the orthophoric range

difference being in feeble-mindedness, which occurred 3 percent *more* frequently among the children born prematurely. They also exhibited a little less than 2 percent *more* nerve diseases and dysfunctions as a group and speech defects than did those born at full term. No instance of vertical muscular imbalance occurred in either group, a finding which tends

TABLE 1

COMPARISON OF THE EYE CONDITIONS OF CHILDREN OF PREMATURE AND FULL-TERM BIRTH

		Frequencies—Total Groups			Medians—Total Groups		
		Full Term	Premature	Difference	Full Term	Premature	Difference
No. Cases:		439 percent	155 percent	percent			
Visual Acuity 20/30 or less	O.D.	20	48	+28	O.D.	20	20
	O.S.	23	51	+28	O.S.	20	30
	O.U.	18	42	+24	O.U.	20	20
Refraction 1.00D. of Hyp. or more 0.50D. of Myopia or more Astig. Spher.		Hyp. percent	Myo. percent	Hyp. percent			
	O.D.	19	14	15	23	—4	+9
	O.S.	24	15	12	23	—12	+8
	O.D.	5	5	6	6	+1	+1
	O.S.	4	7	3	6	—1	—1
Muscular Imbalance 5 P.D. or more Near Dist.		Exoph. percent	Esoph. percent	Exoph. percent			
		2	2	2	2	0	0
		21	6	20	2	—1	—4
Refraction Astigmatic Spherical	O.D.	+.12D.	0	—	.12D.		
	O.S.	+.12D.	0	—	.12D.		
	O.D.	+.50D.	+.37D.	—	.12D.		
Muscular Imbalance	Dist.	0	0	0			
	Near	0	1 P.D. Exoph.	+1 P.D.			

Note: Read plus as—The Premature group presented more than. Read minus as less.

in both groups from five through seven years. Exophoria in near vision appeared first among the premature individuals at eight years and one year later among those born at full term. Although the premature group exhibited some tendency to manifest a *larger* median exophoria as age advanced, the full-term group showed little or no tendency to do so.

Other conditions noted during eye examination are presented in table 3. The frequency differences between the two groups were not marked, the greatest

to confirm the very low incidence of this type of defect among the school children whose eye defects have been studied previously by the author.

The tendency toward more frequent and sometimes greater degrees of defectiveness among those prematurely born raised the question as to whether children born after an abnormally long pregnancy might show defects and deficiencies. Accordingly the full-term and premature groups were compared with another composed of children born during or after

TABLE 2
COMPARISON OF THE EYE CONDITIONS OF CHILDREN OF PREMATURE (IN ITALICS) AND
FULL-TERM BIRTH BY AGES

Age (years) No. of Cases		FREQUENCY BY AGES (PERCENT)																	
		19	5	5	37	6	16	50	7	12	45	8	18	52	9	15	54	10	14
Visual Acuity 20/30 or poorer.	O.D.	53	80	43	63	32	54	26	50	21	53	13	36						
	O.S.	53	80	53	81	38	62	26	50	31	53	16	36						
	O.U.	53	80	43	56	34	46	23	50	21	47	13	29						
Refraction 1.00D. Hyp. or more 0.50D. Myopia or more	O.D.	Hyp.	38	0	20	14	17	17	22	7	24	16	23	0					
		Myo.	4	0	3	7	6	8	8	29	4	0	11	25					
	O.S.	Hyp.	38	0	16	14	17	17	24	7	26	8	26	0					
		Myo.	4	20	3	14	6	8	8	29	4	0	9	14					
	O.D.	Hyp.	13	0	6	0	3	0	0	0		8	4	0					
		Myo.	0	0	0	0	2	0	0	0	2	0	4	8					
	O.S.	Hyp.	13	0	10	0	3	0	3	7	4	8	4	0					
		Myo.	0	0	0	20	8	0	0	0	2	0	4	8					
	Muscular Imbalance 5 P.D. or more.	Dist. Near	Esoph.	0	0	13	0	3	0	3	0	2	0	18	8				
				0	0	30	19	17	0	16	22	13	33	4	31				
Dist. Near		Exoph.	0	20	0	0	7	0	0	0	7	0	22	8					
			0	20	3	0	9	0	9	0	9	8	7	0					
MEDIAN BY AGES																			
Visual Acuity. (Snellen)	O.D.	20	40	20	30	20	30	20	30	20	30	20	20						
	O.S.	20	40	30	40	20	30	20	30	20	30	20	20						
	O.U.	20	40	20	30	20	30	20	30	20	30	20	20						
Refraction	Sph.	O.D.	0	0	0	0	0	+ .50	0	0	0	+ .75	0	0					
		O.S.	0	0	0	0	0	+ .50	0	0	0	+ .50	0	0					
	Ast.	O.D.	+ .75	—	+ .75	— .50	+ .50	+ .50	+ .50	+ .50	+ .50	+ .50	+ .50	+ .50	— .25				
		O.S.	+ .75	—	+ .75	— .75	+ .50	+ .50	+ .50	+ .50	+ .50	+ .50	+ .50	+ .50	— .25				
Musc. Imbal. (Prism Diopters)	Dist.	0	0	0	0	0	0	0	0	0	0	0	1 Ex						
	Near	0	0	0	0	0	0	0	0	2 Ex*	2 Ex	2 Ex	0	3 Ex					

* Ex = Exophoria.

the tenth calendar month. The small number of cases permitted only a consideration of the total group. These children, termed the Hypermature Group, presented consistently higher frequencies of low vision, hypermetropia, and exophoria, and *lower* frequencies of myopia and esophoria than did the full-term group. They also exhibited consistently

higher incidences of hypermetropia and exophoria, and *lower* frequencies of low vision, myopia, and esophoria than did the premature group.

It was noted that the frequency of low vision in the left eye was *higher* than that of the right eye in this group as well as in the others. Whether this general tendency results from the predominance of

FREQUENCY OF AGES (PERCENT)													
35 ¹¹	13	32 ¹²	12	23 ¹³	7	31 ¹⁴	10	25 ¹⁵	10	22 ¹⁶	10	14 ¹⁷	10
16	46	13	45	13	14	6	40	12	40	14	40	21	40
19	46	13	55	13	14	11	40	12	40	18	40	21	30
9	46	9	36	7	14	6	40	12	40	14	40	21	30
28	8	27	45	8	33	7	10	9	10	18	10	23	0
13	25	12	0	24	17	12	20	34	50	24	50	31	50
28	8	27	45	16	33	24	0	9	10	18	10	23	0
13	25	32	0	28	17	16	20	39	50	18	50	31	50
3	8	0	0	8	0	0	10	0	0	6	0	0	0
7	0	4	0	0	17	8	20	17	20	6	20	0	30
8	8	0	9	8	0	0	0		0	6	0	0	0
7	0	7	0	0	17	11	20	12	20	12	20	8	30
3	0	4	9	0	0	7	0	5	10	11	10	0	0
16	11	21	27	24	16	20	30	13	20	29	30	23	50
3	0	0	0	0	0	3	0	0	0	0	0	8	0
3	0	4	0	0	0	6	0	4	0	0	0	8	0
MEDIAN BY AGES													
20	20	20	20	20	20	20	20	20	20	20	20	20	20
20	20	20	20	20	20	20	20	20	20	20	20	20	20
20	20	20	20	20	20	20	20	20	20	20	20	20	20
+.25	0	+.50	+.75	0	0	0	0	0	-.25	+.25	-.25	0	-1.00
+.25	0	0	+.75	0	0	0	0	0	-.25	0	-.25	0	-1.00
+.50	+.50	+.50	—	+.50	+.50	-.25	+.50	-.50	-.50	0	-.50	-.50	—
+.50	+.50	+.50	+2.00	+.50	+.50	-.25	+.25	-.50	-.50	0	-.50	-.50	+.50
0	0	0	0	0	0	0	0	0	2 Ex	0	2 Ex	0	1 Ex
1 Ex	0	1 Ex	2 Ex	1 Ex	4 Ex	0	0	0	3 Ex	2 Ex	3 Ex	1 Ex	4 Ex

right eyedness or from some other cause or causes is a matter for later investigation.

There was no difference in any of the visual-acuity medians in any of the three total groups, but the hypermature group presented a *greater* median spherical hypermetropia than did either of the other groups and the same median muscular

imbalance as the premature group. It appears, then, that the hypermature cases tend to present a frequency of low vision midway between the full-term and premature groups; a higher incidence of hypermetropia and exophoria than either of the others, and muscular imbalance at near which is about as great as that in the premature cases but more frequent

TABLE 3
COMPARISON OF THE EYE CONDITIONS OF CHILDREN OF PREMATURE AND FULL-TERM BIRTH
OTHER DEFECTS AND DISEASE NOTED DURING EYE EXAMINATION

Condition	Frequencies Percent		
	Full-Term Group	Premature Group	Difference
Accommodative insufficiency	0.7	1.3	0.6
Accommodative spasm (marked)	0.7	0	0.7
Convergence insufficiency	0.2	0.6	0.4
Strabismus—Convergent	1.5	1.7	0.2
Divergent	0.9	1.3	0.4
Ophthalmoplegia	0	1.3	1.3
Poor ocular-muscle control	0	1.3	1.3
Defects of binocular vision	3.0	4.0	1.0
Nyctalopia	1.1	1.3	0.2
Congenital cataract	0.5	0.6	0.1
Pallor of temporal side of discs	0	0.6	0.6
Hard of hearing	0.7	0	0.7
Nose obstructed	0.5	0	0.5
Speech defect	0	1.9	1.9
Psychoneurosis	1.1	0	1.1
Nerve disease or dysfunction	1.3	3.2	1.9
Feeble minded	0.2	3.2	3.0

than in either the full-term or premature groups. The complete data are presented in table 4.

The outstanding facts disclosed by the present study are the *higher* frequency of poor vision among children of premature birth at all of the ages from 5 through 17 years, and the *poorer* median visual acuity of the same group through the ninth year. While this is true of the cases involved in this particular investigation it suggests the probability that many prematurely born children enter school before being ready visually to compete with normally seeing children and go through at least four or five school years before attaining 20/20 vision. Other conditions tending to occur more frequently or to a greater degree among those born prematurely emphasize the less rapid development of this group. These findings do not support the gener-

TABLE 4
COMPARISON OF PREMATURE AND FULL-TERM GROUPS WITH A HYPERMATURE-BIRTH GROUP

Frequencies—Total Group					Medians—Total Group					
		Hyper	Difference from		Hyper	Difference from				
			Full Term	Premature		Full Term	Premature			
No. of Cases		25 percent	percent	percent						
Visual Acuity 20/30 or less	O.D.	24	+4	-24	Visual Acuity	O.D.	20	0	0	
	O.S.	36	+13	-15		O.S.	20	0	0	
	O.U.	24	+6	-18		O.U.	20	0	0	
Refraction 1.00D. of Hyp. or more 0.50D. of Myopia or more Astig. Spher.		Hyp. percent	Myo. percent	Hyp. percent	Refraction Astigmatic Spherical	O.D.	+1.00D.	+ .85D.	+1.00D	
	O.D.	40	4	+21 -10		+25 -19	O.S.	+1.00D.	+ .85D.	+1.00D.
	O.S.	36	4	+12 -11		+24 -19	O.D.	+ .50D.	0	+ .12D.
	O.D.	12	0	+7 -5		+6 -6	O.S.	+ .50D.	0	0
	O.S.	16	0	+12 -7		+13 -6				
Muscular Imbalance 5 P.D. or more Near Distance		Exoph. percent	Esoph. percent	Exoph. percent	Muscular Imbalance	Dist.	0	0	0	
		5	0	+3 -2		+3 -2	Near	1 P.D. Exoph.	+1 P.D.	0
		30	0	+11 -6		+10 -2				

Note: In difference columns read plus as more; minus as less. Read -4 percent as: The hypermature group presented 4 percent less.

ally held belief that the ill effects of prematurity are overcome quite early in life and are of no particular importance thereafter. Apparently, there is a tendency for visual handicaps to persist into the middle grades. It is also notable that a small group of children of hypermature or late birth presented defects and deficiencies which led one to think that hypermaturity may prove to be somewhat similar to prematurity as an initial handicap.

SUMMARY

One hundred fifty-five children who were born before completion of the normal term of pregnancy or who weighed $5\frac{1}{2}$ pounds or less at birth are compared

with 439 children born at full term or with a birth weight of more than $5\frac{1}{2}$ pounds. These two groups are compared with a smaller group of children born during or later than the tenth calendar month. The outstanding tendencies noted are the higher frequency of low vision at all of the ages studied among those born prematurely and the poorer median visual acuity through the ninth year in the same group. The presence of somewhat comparable defects and deficiencies in both the premature and hypermature groups provides a suggestion that hypermaturity may prove to be of similar but probably less importance than is prematurity as an initial handicap.

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VISION IN INDUSTRY*

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In a report of the Committee on Industrial Ophthalmology of the Section on Ophthalmology of the American Medical Association, read before the fourth annual Congress on Industrial Health in Chicago, January 13, 1942, the scope of industrial ophthalmology was divided into five interrelated parts, as follows:

1. The efficient use of vision in industry.
2. Eye accidents—their prevention and the treatment of injuries.
3. Conservation of visual health.

4. Visual economics—the effect of vision on earning ability and on production.
5. Medicolegal ophthalmology.

The report goes on to state that the most neglected field of industrial ophthalmology relates to efficient visual performance (items one and four, above), and that the study of visual effectiveness includes the following topics:

1. Basic elements of visual performance—the need of standards for essential functions of vision for specific jobs.
2. Methods and techniques of testing.
3. Ways and means of correcting visual defects.

*From the Bausch and Lomb Optical Company. Read before the fourteenth annual Mid-Winter Post-Graduate Clinical Convention in Ophthalmology and Otolaryngology, Los Angeles, California, January 22, 1945.

4. Placement of employees according to visual qualifications.
5. Health factors that influence vision.
6. Programs of coöperation between management, employees, industrial medical departments, and ophthalmologists in establishing practical methods of visual testing, correction, and placement.

In studies of the first four of these topics, the chief interest has lain in the individual visual differences of people; for people differ—by nature, training, education, and inclination.

The economic significance of these individual differences is appreciated by management, because a misplaced employee brings about many complications. Management knows that the outputs of identical machines, manned by different operators, are seldom the same. Some operators may be trying to work beyond their capacity. Some are poor producers, some good, some superior. Some have many accidents, some few, some none. Too, recent legislation has made difficult the promiscuous hiring and firing that was easily possible a dozen years ago, and employers today have a higher sense of social obligation. Hence, the consideration of individual differences in the selection of applicants for placement on any job is becoming more and more important.

There have been numerous excellent studies in this field both in this country and in England.^{1,2,3} The work of the past five years has been largely in the realm of testing methods and in the actuarial approach to the factual interpretation of visual problems in industry. In applying the facts disclosed by such study, industry is uncovering many employees who must be referred for professional attention. It is, therefore, imperative that ophthalmologists know about this fact-finding pro-

gram and the varied visual needs of industry.

The mention of visual needs of industry probably immediately conjures up in the reader's mind a picture of the norms with which he deals daily, in terms of 20/20 Snellen acuity at distance, orthophoria at far, six prism diopters exophoria at near, and so forth. No such inflexible standard of perfection applies in industry any more than does a standard of physical fitness which would require each person to have a head size of exactly 67%. Whether in industry, or elsewhere, according to Snell,⁴ "Good vision is that degree of visual functional ability which is adequate to perform the visual task presented." This definition should be kept in the forefront, for it removes the rigid standards of previous thinking and substitutes the standard that fits each case. It eliminates the idea of one standard of perfection—good distance acuity on the Snellen chart—which has led personnel placement astray in its attempt to allocate employees properly to jobs.

Almost every job requires some visual skill. Some jobs require very highly developed visual skills. Certain skills must be more highly developed than others for some jobs. For example, such a skill as good distance acuity, which is necessary for the crane operator, is contraindicated for the hosiery looper or radio-tube assembler who requires good near acuity. A negative correlation has been found between distance acuity and production in looping hosiery.⁵ There are, then, jobs that require certain skills and for which other skills are not required.

Researches conducted (and continuing) in various industries on thousands of employees by Professors Tiffin, Wirt, and co-workers of Purdue University, and Dr. Hedwig S. Kuhn, have shown that of all the tests that have been tried there

are 12 measures of individual differences that are most useful in correlating visual skills with performance on the job. Seven of these are distance tests and five are near tests.⁶

1. Vertical heterophoria—far
2. Lateral heterophoria—far
3. Binocular acuity—far
4. Right-eye acuity—far
5. Left-eye acuity—far
6. Color discrimination
7. Vertical heterophoria—near
8. Lateral heterophoria—near
9. Binocular acuity—near
10. Right-eye acuity—near
11. Left-eye acuity—near
12. Stereopsis

The individual differences disclosed by these tests are certainly revealing of some facts which have not been fully appreciated in the past. As an example, suppose that several milling-machine operators

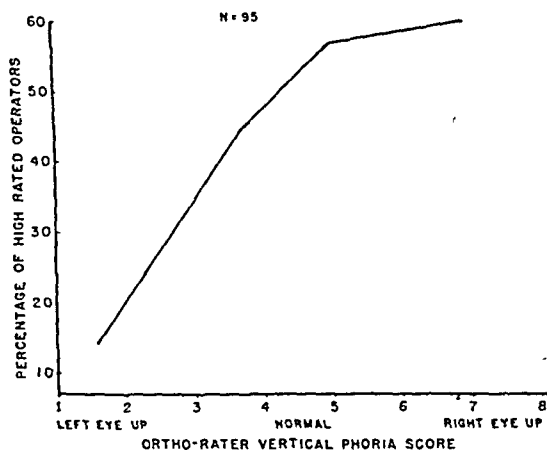


Fig. 1 (Lueck). Relation between near vertical phoria and rated success for milling-machine operators. From Tiffin and Wirt, in *Jour. Consult. Psych.*, 1944, v. 8, pp. 80-89.

from a nearby plant present themselves for visual rehabilitation, and in the course of the examination disclose a hyperphoria of the right eye. The refractionist's tendency would be to correct it in the spectacle lenses by prescribing the necessary amount of prism, base down,

in the right lens. Yet such action might seriously disturb those men on the job, cause lower production, and increase spoilage. Facts gathered seem to indicate that a hyperphoria of the right eye can be tolerated on the job, whereas a hyperphoria of the left eye cannot be tolerated (fig. 1).

This should have been anticipated, now that we know the facts, from a close

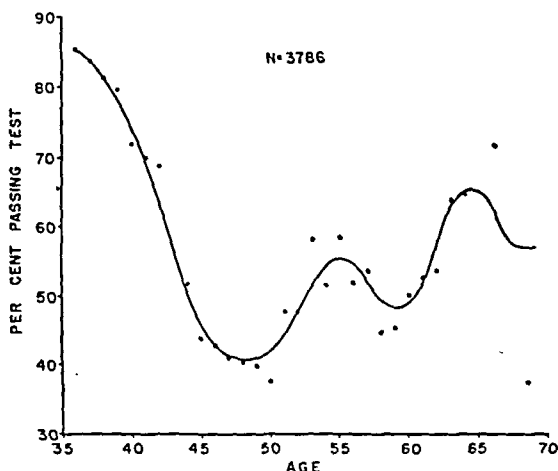


Fig. 2 (Lueck). Relation between age and visual discrimination at near. The two peaks occur at the age at which the average man obtains his first bifocals and at the age at which he obtains his second and last pair. From Tiffin,¹⁰ "Industrial psychology," p. 150.

study of how a milling-machine operator holds his head in watching and setting the machine. Over a period of years he develops this hyperphoria as an occupational characteristic peculiar to this job, and until milling machines are redesigned to eliminate this phenomenon of "right eye up," milling-machine operators will continue to develop this tendency.

Another interesting comparison, of the many that might be drawn, is one which relates the number of persons, passing a simple near-acuity test, with age. This comparison shows graphically a fact long known to manufacturers of bifocal lenses, and one affecting the relative numbers of different segmental additions made and

stocked. People put off getting bifocals. Kuhn⁷ states that patients are too often aided and encouraged in this practice by the prescribing of the "compromise" lens.

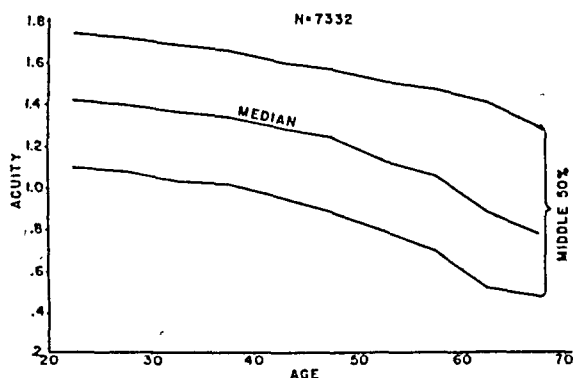


Fig. 3 (Lueck). Relation between age and distance visual acuity. From Tiffin, "Industrial psychology," p. 149.

Further, people in general make an average of two trips for professional attention after presbyopia becomes noticeable. One trip is made between the ages of 45 and 55 years, and a final trip between the ages of 60 and 65. The curve in figure 2 discloses that presbyopia is already affecting some individuals at the age of 35 years. The trend of diminishing near acuity is not arrested by increasing use of spectacles until about age 50; and even with whatever reading glasses and

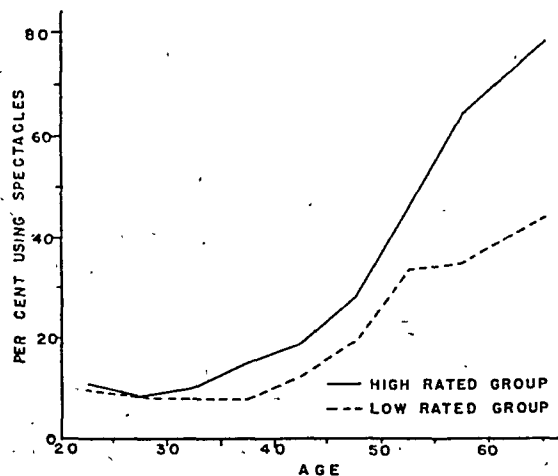


Fig. 4 (Lueck). Relation between age and use of spectacles for general wear by high-rated and low-rated employee groups. From Tiffin, "Industrial psychology," p. 145.

bifocals are procured, this loss in near acuity is never fully compensated in any typical industrial group. Obviously, there is need for more attention to patients requiring bifocals, and need for better publicization of the potentialities of multifocals. There is a need for the greater use of trifocals to raise the acuity-performance level. Trifocals are often indicated at about age 50 when the nearest point of clear vision through the distance lens is beyond the farthest point of clear vision through the near portion. The shift from bifocal to trifocal should be seriously

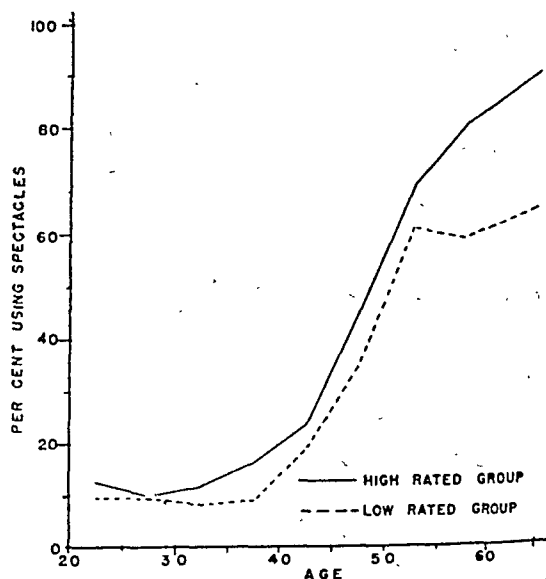


Fig. 5 (Lueck). Relation between age and use of spectacles for near vision by high-rated and low-rated employee groups. From Tiffin, "Industrial psychology," p. 146.

considered at the time of prescription of a +2.00D. sph. add.⁸ Some jobs will demand a shift to trifocals before a +2.00D. sph. add is needed.

Visual skills vary with age. This is widely appreciated so far as near acuity is concerned; but investigation shows interesting trends in other functions, too. Figure 3 shows the relationship between distance acuity and age for over 7,000 employees in a steel mill. The upper and lower curves enclose the middle 50 percent of the acuity scores made at each

age. Since these curves are practically parallel it is obvious that the spread of scores changes little with age. Hence, the conclusion can be drawn that loss of acuity with age is universal. As a result, industry is beginning to recognize that a satisfactory level of employee visual acuity today may be unsatisfactory later and that employee job performance may be affected by this change with age. Likewise, industry is becoming aware of the fact that those employees who use spectacles for constant wear or for near use are, in general, better in job performance (figs. 4 and 5). Therefore, it can be expected that periodic rechecking will be encouraged among the employees.

Some jobs such as dyeing, paint mixing, color printing, wiring of electrical devices with colored insulation wire, the sorting of colored plastic products, and the like, require the skill of good color discrimination. Simple tests for the detection of color blindness are coming into use in industry; but this is not enough. What is needed is a simple means of evaluating the "color-normal" worker's capacity for hue discrimination, for this varies considerably from individual to individual quite apart from ability or inability to identify and name colors properly. Two workers may both pass color-blindness tests with perfect scores, and yet differ greatly in ability to discriminate close-together shades of red or close-together mixtures of yellow and green. And, there is evidence that this ability changes with age.⁹ Methods of testing color discrimination are being studied and developed, and will eventually be made available to industry in the form of simple instruments or additions to present test-batteries.

There are many jobs that demand some degree of stereopsis for best performance. Among some that might be mentioned are truck operation, assembling, and inspec-

tion on small parts. Depth perception changes with age, too, but does not decline steadily. Rather, in most cases, this skill increases up to about age 30, remains fairly stationary until approximately age 50, then declines rapidly (fig. 6). One explanation for the increase in stereoptic acuity from age 20 to 30 is that experience in work requiring perception of depth improves this function. This explanation has been advanced independently by Snell and Kuhn. Tiffin¹⁰ concludes that this ex-

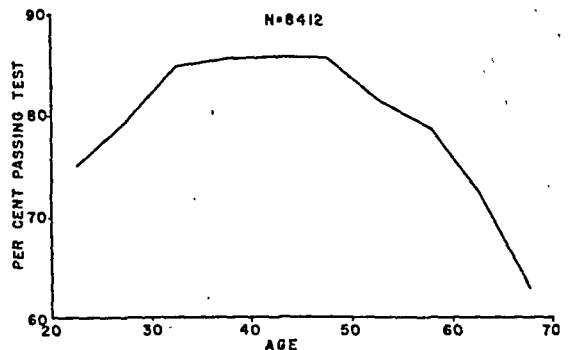


Fig. 6 (Lueck). Relation between age and stereoptic acuity. From Tiffin, "Industrial psychology," p. 152.

planation implies that an increased ability to perceive depth may be accelerated through training.

Adaptation to some jobs changes visual skills. Particularly is this true of near-point applications such as inspection and assembly operations on small parts and close-tolerance manufacturing operations. By way of comparison we might look at the distribution of near-acuity scores for groups with less than six months' experience versus groups with over six months' experience in radio-tube assembly (fig. 7). Tiffin and Wirt⁵ suggest that there are at least two possible causes for this difference: Only persons with exceptionally good near acuity will stay on the job; or, acuity improves on the job. Some 26 percent of the employees in the senior group wore glasses; but 20 percent had glasses in the junior group,

which does not suggest that the higher acuity in one group was due to any greater use of professional eye care and optical aids.

Another near-point task, hosiery loop-

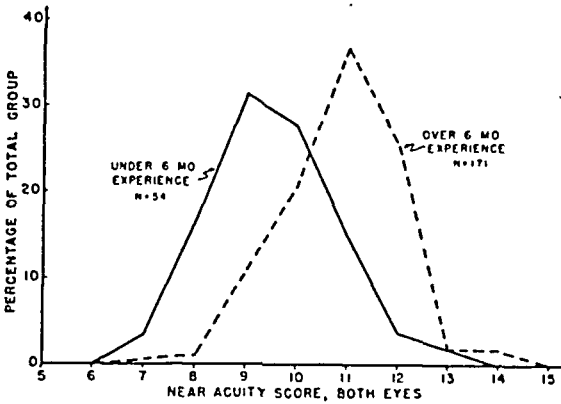


Fig. 7 (Lueck). Relation between near acuity and experience on the job for radio-tube assemblers. From Tiffin and Wirt.⁵

ing, also causes shifts in skills with tenure on the job. Figure 8 shows the relation between the number of employees passing a distance-acuity test and experience on the job. There is a very substantial downward trend in distance acuity which manifests itself whether or not glasses are worn. This might be expected as the result of continued work at the extremely close distance of 8 inches neces-

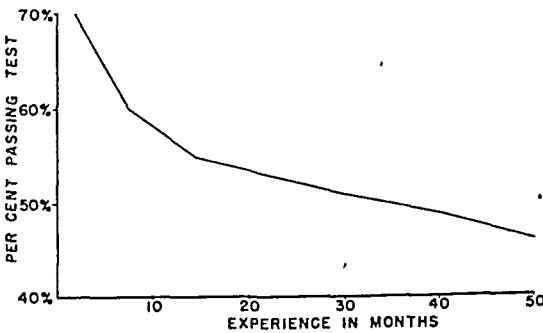


Fig. 8 (Lueck). Relation between distance visual acuity and experience on the job of hosiery looping. From Tiffin, "Industrial psychology," p. 153.

sary to obtain an enlarged image of the work so that it can be seen adequately. The actual change in focus posture was measured and is shown in figure 9. These people became "occupational myopes."

Of interest to management and the safety engineer are relationships between visual skills and accident rate. Unfortunately, the accident may not have happened to the particular employee whose poor vision was the cause, and the statistical approach to this problem is not easy, since adequate records are difficult

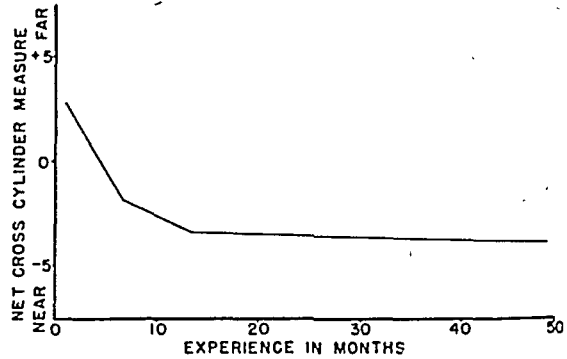


Fig. 9 (Lueck). Relation between focus posture and experience on the job of hosiery looping. From Tiffin, "Industrial psychology," p. 154.

to obtain. The breaking of a defective machine part may injure a workman through no fault of his. The blame should lie with the inspector—usually in some

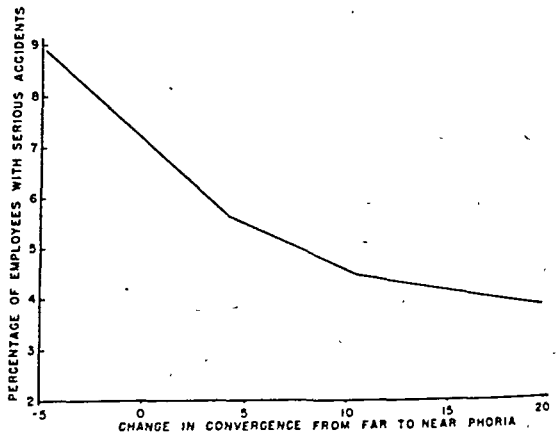


Fig. 10 (Lueck). Relation between heterophoria and serious accidents. From Tiffin and Wirt, in Jour. Consult. Psych., 1944, v. 8, pp. 80-89.

other factory—who passed the machine part. One relationship that has been found is shown in figure 10. This shows the accident rate versus the algebraic

BAUSCH AND LOMB OCCUPATIONAL VISION TESTS
WITH THE ORTHO-RATER

PLANT _____ SCORE SUMMARY SHEET NO. _____
DEPARTMENT _____ TESTING DATES TO BY
JOB _____ TABULATED DATE BY FILE

NEAR TESTS									
TEST SCORE	PHORIA			ACUITY			PHORIA		
	Vertical	- Lateral	- Both	- Right	- Left	- Both	Vertical	- Lateral	- Both
15	1						10		
14							4		
13	1						5		
12							2		
11							4		
10							6		
9	2						13		
8	6						14		
7	23						17		
6	64						27		
5	48						61		
4	16						54		
3	6						19		
2							10		
1	2						3		
O							9		
X	(3)	(3)					(2)	(3)	
N	167	167	170				170	168	167
Σ									
Σ²									
M	5.60	6.86	9.32				1.95	4.43	6.83
S.D.	1.23	2.57	1.33				2.54	1.36	3.60

Fig. 11 (Lueck). Summary sheet of scores made on each of the 12 visual tests administered to 170 piston-ring inspectors. See footnote marked †. Kindly furnished by Dr. Wirt (unpublished).

sum of far and near heterophorias. From this curve we ascertain that those with the *least* change in convergence effort from distance to near show the greatest accident rate; those with the *greatest* change in convergence effort from far to near show the lowest accident rate. This observation relates directly to the changes in convergence that occur with changes in stimulus to accommodation, which, in turn, are affected by the lenses prescribed.

Another study¹¹ compared visual skills as found in injury-free groups with visual

piston-ring inspectors and from the application to them of the previously mentioned battery of 12 visual tests by means of the Ortho-Rater, a precision Brewster-type haploscope.

Figure 11 is a reproduction of the summary sheet of scores made by all the people in the department, on each of the 12 visual tests administered. Scores for right and left eye have been deleted to avoid the confusion of many numbers, since neither the right nor the left eye is specifically important on this job.[†] A record of the scores for the poorer eye has, how-

TABLE 1
VISUAL ACUITY IN 170 PISTON-RING INSPECTORS

Test Score:	4	5	6	7	8	9	10	11	12	13	14	15	Number	% of whole group	Mean	N ₁	%
Sub-group "A" (best rated)						2	11	13	11	1	1		39	23.0	11.02	37	27.3
Sub-group "B"	1					1	16	17	14	1		1	51	30.0	10.90	49	36.0
Sub-group "C"					5	13	13	13	5	4			53	31.1	10.22	35	25.7
Sub-group "D" (poorest rated)	1			2	1	8	4	7	3	1			27	15.9	9.80	15	11.0
Total	2			2	6	24	44	50	33	7	1	1	170	100.0		136	100.0
% A & B Operators			10			13	61	60	76	44.5							
			r e j e c t a b l e s				a c c e p t a b l e s										

N.B.: N₁ and associated % figure, show number and percentage of operators remaining in each group after application of standard chosen.

skills as found in serious-injury groups and in groups showing high frequency of minor injuries. It was found that the injury-free group was significantly superior to the serious-injury group in acuity of the poorer eye at near. The injury-free group was also significantly superior to the high-frequency-of-minor-accident group in regard to lateral heterophoria at far and in depth perception.

Now that we have considered briefly the visual skills that have been found important in industry, some of the individual differences for various skills, their variation with age and with experience on the job, and their relation to accidents, it may be profitable to consider a specific group of workers. Let us see what statistical evidence has been developed from the ratings, on the job, of a group of 170

ever, been made. If this total group is broken up into the superior, good, fair, and poor operators according to their production or other performance rating on the job, and a summary sheet such as this is prepared for each sub-group, the arithmetical means of the scores for (say) acuity at near computed, and the means from sub-group to sub-group compared, the mean-acuity scores will show a progressive decrease from best to poorest employees (table 1). The findings of this

[†] It should be pointed out here, however, that on some jobs it is important to know whether the right or left eye has the better acuity. Job layout is often such that binocular vision of the work is prevented by the hand or by some object in the line of sight of one eye. This peculiarity is disclosed by close inspection and also by the correlation of right- or left-eye vision with job performance as revealed by testing.

particular test, then, are related to performance on this job.

If, for each score, the percentage of superior and good operators is computed, a practical score limit at one or both ends of the scale is obvious. In this case, employees scoring below 10 are rarely good operators. If all the employees on this job were selected from among those who score 10 or better on binocular near acuity, the percentage of superior and good operators would be materially increased and the percentage of fair and poor operators materially decreased. The percentage change for the near-acuity visual standard adopted is also shown in table 1. The other visual skills significant on this job were likewise analyzed, of course, and a complete pattern of visual job requirements resulted. It was then possible to conclude that if every worker on this job had been able to meet these requirements, the output of the group would have been about 9 percent greater.*

The economic value of changes in this magnitude are very considerable in industry. Increases in production as small as 3 percent show a worthwhile saving on any substantial volume of production. For instance, a production increase of 3 percent on a \$3,000,000 yearly business would mean a saving of \$90,000.

One question that is certain to be raised relates to the employee who does not meet the visual job standards. What becomes of him? He is referred for professional attention and visual rehabilitation. We have no guarantee, however, that the rehabilitation will cause the employee to improve on the job. There may be other reasons for his failure. He may be better suited to some other work, and this will probably be disclosed in the careful consideration of his whole case. We do know that (other things being equal)

the man has a much better chance to make good on the job if his visual skills meet the job's requirements, and he will have a poor chance to make good if his visual skills do not meet job requirements. New employees should possess at least the minimal visual skills established as needed for the job.

It should be remembered that the entire battery of industrial-vision tests and the accompanying statistical fact-finding program for employee placement are not intended to "screen out" employees, and keep them from obtaining work. Different jobs have different visual demands. There are jobs in industry even for the blind. An industrial-vision employee-placement program permits the finding and establishment of visual-skill standards that will result in assignment of the better potential producers to a specific job. Other specific jobs have other visual requirements, and the employee not meeting one set may meet another and be put to work on the job for which he is best fitted visually. Further, these standards are flexible. They can be made more stringent in periods of plentiful labor and relaxed during periods of a tight labor market, with a full knowledge of attendant production changes that will occur. An employee-placement program based on known visual abilities will prove most satisfactory to both labor and management.

Rehabilitation of employees for any specific visual task has been mentioned, as has the specific peculiarity of the hyperphoria of the right eye found in milling-machine operators. The reader may have been wondering how he could know just what visual skills are required of any factory employee who is referred to him for eye care. One thing can be asserted: the employee will not be able to say how he uses his eyes. If questioned he may say that he operates such-and-such a ma-

* This information, as yet unpublished, was kindly furnished by Drs. Tiffin and Wirt.

chine. Pressed for more information, he will tell all about what the machine does—but not what he does, or how he uses his eyes. He will not be able to estimate at all exactly the working distances—ahead, to right, left, down, and up—that are imposed upon him, nor will he be able to estimate accurately what these distances should be. It becomes the clinician's problem to figure out these facts. This can be done in either of two ways. One can visit the plant and familiarize himself with the needs of the workers on each type of machine. When it is practical, this is the better method. Or, one can arrange with the plant's medical, person-

nel, or safety department to have the pertinent data furnished. This will usually be done as a matter of course as soon as the plant gets a visual fact-finding system underway.

Then, with the necessary data on the visual skills required and with the patient at hand, the problem is to try to give him comfortable working vision for the job, and yet allow him suitable vision for his life away from work. That is a problem which involves many considerations, principally in the relationships of accommodation, convergence, and visual acuity.

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A VISUAL TEST FOR INFANTS

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There are occasions in ophthalmic practice when it is desirable to demonstrate the visual efficiency of an infant. Although it is possible to make accurate eyeground studies and measurements of the refractive error and although the examiner may be able to form a general opinion satisfactory to himself, the parents are more satisfied if the ophthalmologist can actually demonstrate the child's ability to see.

The illiterate E symbol turned at different axes is often useful for this purpose in children of three years of age or older and occasionally in children somewhat younger. There is a wide gap between the newborn babe and the period when the illiterate E is useful. We are not taking full advantage of our opportunities in our study of visual response in this earliest age group. The device herein described gives ample support to this statement.

We have all seen these very small infants picking at minute specks on the coverlet and they seem particularly interested in small bugs or moving objects. In order to take advantage of this infantile curiosity, the test object as advocated for angioscotometry was quite successful in demonstrating the vision of these children. This minute white ball mounted upon a black stem is moved about against a black background. The idea of using minute dots for testing vision is, of course, not new. Grains of pollen were sometimes used in the days before Jaeger advocated type sizes.

It seemed more advantageous, however, to employ a means by which the examiner's hand would not appear in the field of the subject's vision, thereby distracting attention. To this end a small

tray (six inches by six inches with a one-inch rim) with replaceable white opaque plastic bottom was devised as a background for the test. The test objects themselves at present are iron filings. These are caused to move about on the



Fig. 1

white surface by manipulating a bar magnet* on the underside of the tray so that the only object in the infant's field of observation is the minute black speck (fig. 1).

It is obviously desirable to have a series of sizes of these objects and it seemed at first difficult to devise a satisfactory method of retaining the iron filings and at the same time keeping the various sizes separated. It was finally found practical

* The new and more powerful permanent magnets are available but the permanent magneprobe magnet is ideal.

to select appropriate sizes and stick them to strips of paper by means of mucilage. Each strip bears an appropriate number indicating the size of the filing as measured with a micrometer.* When objects larger than 0.5 mm. are desirable, it is possible to use steel ball bearings which can be purchased in graduated sizes. One can then test the child with gradually increasing sized objects until its attention is attracted by the movement.

The infant is held on the mother's lap facing the examiner. A uniform illumination is caused to fall upon the tray from above and behind the subject so that no shadows may distract the child's attention. A few preliminary tests may be run and the mother may participate in order to gain the infant's full coöperation. When the child's interest has been once aroused, the mother covers one eye with her hand and the examiner then watches for the child's interest to develop. When an amblyopic eye is covered, the child's interest is maximum. When, however, the "good eye" is covered and the amblyopic eye is exposed, the child will endeavor to remove the mother's hand in order to pursue the minute speck. It is this reaction on the part of the infant which insures the dependability of the test even more than the child's unsuccessful efforts to find or follow the movements of the filings.

Should the child succeed in getting one of these specks into its mouth, the minute iron filing or even ball bearing, would not in any way injure its mouth or digestive organs.

Those cases in which the child does not respond (as with congenital cataracts, or other developmental defects) to the largest-size ball bearing, an increase in the intensity of the stimulus may be ob-

tained by applying the ophthalmoscope stem with its mounted pinhole cap applied directly to the underside of the translucent tray bottom. A sharply defined and measurable light disc is projected through the bottom. Its intensity can be varied by adjusting the rheostat† and its size can be modified by using caps of varying-size apertures. The spot is caused to move about on the surface of the tray so that the child's attention is held and its responses noted in the same way as when the iron filings or ball bearings are used. The tray may be held vertically so that the examiner can look over its edge in order to be sure the movements of the child's eyes coincide with those of the illuminated spot.

The illustration will supply an adequate idea of the construction and application of the device.

It is, of course, obvious that in any event the test does not measure visual acuity but rather a condition of responses to brightness, contrast, and movement. Contact has been made with a number of ball-bearing manufacturers. They are unable to supply more than samples until the war is over. The smallest sample thus far supplied measures 1/64 inch in diameter. Smaller sizes are desirable—about 1/100 of an inch will probably be about right. Only one size object will be necessary, as additions of one or more follow the movements of the magnet as one.

After examining a number of hundred infants with iron filings and comparing the results of the examinations, the writer concludes that many children as young as three months old give reliable responses to the movement of the iron filings (table 1). No effort has been made to tabulate the results as it has been impossible to

* It is, of course, not possible to secure filings of exactly uniform size.

† Variations of intensity are to be avoided when possible as they are not measurable and involve color change.

TABLE 1
RESPONSE TO VISUAL TEST FOR INFANTS

Age	Stimulus	Nature of response	Responding percentage	Assumption	Remarks	Authority
Term*	Intrusive reflex	Aimless wandering	100		Movements not greater than 35°. Horizontal only.† Not continuous.‡ No family history of squint	A
First 10 mins.	Flashlight	Lid reflex	100	Retina functioning	Pupils react. About 1 per 1000 have brown iris irrespective of color or race	B B
During first 10 days	Flashlight	Transient convergence reflex	9	Macula begins to function	Same as above	B
5-6 weeks	Flashlight or massive objects	Follows movements with eyes for few seconds	100 ?	Developing macula function and muscle coordination	Approach of nurse or mother more frequently noted	A
6-8 weeks	Smaller objects	Follows movements for few seconds	100 ?	Same as above		A
3-4 mos.	1" black cube against white surface at 2'	Follows movements for 1/2 minute	100 ?	Visual acuity 6/728.00	Head moves. Also inspects own hands. †Crude as an actual measurement	A
6 mos.	1 3/4" black cube against white surface at 2'	Follows movements through full angle of eye movements	100 ?	Visual acuity about 6/288.00	†Method of testing can be improved. Has perceived red and yellow for about three months	A and C
9 mos. to 1 yr.	Black cubes on white	Follows with eyes. Hands and body in prolonged attention.	100 ?	Development and coordination of all eye functions. Visual acuity about 6/72		A
2 yrs.	E chart	Indicating position of letter	100 ?†	6/12		A
3 yrs.	E chart	Indicating position of letter	100 ?†	6/12		A
4 yrs.	E chart	Indicating position of letter	100 ?	6/9		A
5 yrs.	E chart	Indicating position of letter	100 ?	6/6		A
6 yrs.	Snellen	Reads	100 ?	6/6	From this point on less liable to develop strabismus	A

* It has been pointed out that if a powerful light be flashed on the abdominal wall of a pregnant woman shortly before term, fetal movements will become more active. This may not be an ocular response at all. The writer does not believe that this is 100 per cent, however.

† Inserted by J.N.E.

‡ In my experience only 50 percent of children two years of age will respond.

? Percentage questioned by the writer.

Authority:

A Chavasse, F. B. Worth's squint or the binocular reflexes and the treatment of strabismus. Ed. 7, Philadelphia, P. Blakiston's Son & Co., Inc., 1939, p. 90 ff.

B Bull. Neur. Inst. New York, 1932, v. 2, March, p. 12.

C Duke-Elder, W. S. Textbook of ophthalmology. Henry Kimpton, 1932, v. 1, p. 886.

Also National Society Prevention of Blindness, Pub. 66, p. 18. Public Health Bulletin 182, U.S. Government.

secure the necessary minute ball bearings to use if the test is to have quantitative value.

A partial survey of the literature permits the tabulation of certain norms of judging visual responses in infants. It will be noted that some of the methods

are very crude.

The test tray and method herein presented allow a study of the child's responses nearly from birth until he is able to read the usual illiterate "E" charts.

23 Schermerhorn Street (2)

REPEATABILITY OF KERATOMETRIC READINGS*

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INTRODUCTION

The reliability of the various measurements made in the determination of ocular anomalies is a question that arises occasionally. Opportunities for determining the accuracy or repeatability of ophthalmic instrumentation are infrequent. The time and cost to the patient and to the examiner are factors that often outweigh the other values of studies of this kind. Nevertheless, it is important that the reliability of the instruments and techniques used be known. The final result of any examination will be influenced by the reliability of the instruments and techniques used; this in turn necessarily depends on the stability of the conditions being measured and on the possible variations in measurement due to the interpretation of the examiner.

With respect to the keratometer two of these factors—namely, the reliability of the instrument and the effect of the examiner's interpretation—are determined in this study.

The stability of corneal curvatures in nonpathologic cases is generally accepted. The role which ophthalmometry should play in the determination of the total ametropia has been discussed innumerable times and need not be considered here. In the presentation of the data, however, the subjective refractive corrections are included for the interest that they may have for some readers.

Few studies dealing with the repeatability of ophthalmic instrumentation can be found in the literature. For example,

*From the Clinical Division of the Dartmouth Eye Institute, Dartmouth Medical School.

the repeatability of the ophthalmo-eikonometer measurements was reported¹ in 1940. This study included also the repeatability of the refractive error as determined by the method of stigmatoscopy.

The nature and statistical frequency of astigmatic errors have been recently studied in the prescriptions given to 2,000 consecutive patients at the Dartmouth Eye Institute. Astigmatic corrections below 0.25D. cyl. were not considered. The results of the study are given in the following table:

TABLE 1
DISTRIBUTION OF ASTIGMATIC ERRORS

Type of Astigmatism	Number of Patients	Percentage
With the rule	631	31
Against the rule	412	21
Oblique (axis 20° off the horizontal or vertical)	562	28
With the rule in one eye and against the rule in the other eye	57	3
No astigmatism or astigmatism below 0.25D.	338	17
Total	2000	100

From this table it is seen that 83 percent of the patients had astigmatic errors of 0.25D. cyl. or more, whereas the astigmatism of the remaining patients was considered insignificant.

It is obvious from the high prevalence of astigmatic errors in routine refractive cases that all refractionists should be aware of the reliability of the instruments and methods used to detect astigmatism. Since the cornea constitutes four fifths of the total refracting power of the eye, the measurement of the curvature of this surface determines the main seat of as-

tigmatism. Aside from regular refractive cases it is helpful in cataract surgery to know the corneal curvatures before and after the operation. The surgeon may be guided in the type of operation when he has found by keratometric readings that certain techniques result in more post-operative astigmatism than do others. The use of the keratometer in aniseikonic examinations enables one to calculate ^{2,3} the expected meridional image-size difference and, in the case of oblique astigmatism, the declination error. In contact-lens fitting, in cases of amblyopia, in cases of suspected malingering, and in cases of corneal pathologic change the keratometric measurements provide objective data of value which, as this study shows, may be relied upon as being accurate and affected to only an insignificant extent by the personal error. This paper reports a study of the reliability of the keratometric or ophthalmometric measurements.

METHOD

A comparative study was made of the cases in which two keratometric measurements had been taken on the same patients* within a period of less than six months. A period of less than six months was impractical because only a few patients returned within a shorter period. Measurements on 50 unselected patients are reported, entailing 200 readings on 100 eyes. Despite the small number of cases used in this study, the results are so definite that it seems justifiable to present them at this time. The measurements were taken by six different examiners, but the majority of the readings were made by only two. The keratometers used were those made by the American Optical Company, by the Bausch and Lomb Opti-

cal Company, and by Carl Zeiss, Inc.; however, most of the measurements were taken on one instrument.

DATA

The data on 100 eyes are given in the following table (table 2.). The age of the patient, the repeated keratometric readings, the subjective refraction, the instrument used, and the initial of the examiner are included in the table.

The average age of the 50 patients included in this study was 32 years, the range being 8 years to 60. The average amount of corneal astigmatism measured in the 100 eyes was 1.32D; the range was from 0 to 5.25D. The average amount of subjective astigmatism for the 100 eyes was 1.09D.; the range was from 0 to 5.00D.

In the following tables (3 and 4), the differences in amount and axis of the corneal astigmatism between the repeated readings are summarized.

The maximum difference in the amount of the corneal astigmatism determined by the repeated readings was 0.75D.; the average difference in amount was 0.14D. In 68 percent of the cases the difference in amount was 0.12D. or less. In 92 percent the difference in amount was 0.25D. or less. This indicates that although a few deviations may be relatively large (the maximum being 0.75D.) most of the differences between repeated readings are very small (less than 0.25D.).

The maximum difference in axes between repeated readings was 15° but the average difference was only 3°. In 66 percent of the cases the variations in axes were 3° or less. In 87 percent of the cases the variations were 5° or less. These average deviations in amount and axis between repeated readings are very small.

An attempt was made to find a relation-

* None of the patients included had any corneal pathologic change or corneal irregularities.

TABLE 2
REPEATED KERATOMETER READINGS

Pat.	Age	Double Readings*		Corneal Astigmatism	Differences		Exam- iner	In- stru- ment	Subjective Astigmatism
		Primary Meridian	Secondary Meridian		Amt.	Axis			
1. JE	24	45.25/25	46.25/115	-1.00×25	0.25	5	B	B	+1.50-0.25×180
		46.00/20	46.75/110	-0.75×20			W	B	
		45.00/20	46.00/110	-1.00×20	0	13	B	B	+1.75-0.50×180
		45.25/7	46.25/97	-1.00×7			W	B	
2. ED	44	41.75/10	43.25/100	-1.50×10	0.50	14	W	B	-1.50×178
		41.25/176	43.25/86	-2.00×176			B	B	
		41.75/13	43.25/103	-1.50×13	0.37	0	W	B	-1.50×10
		41.25/13	43.12/103	-1.87×13			B	B	
3. WJ	27	43.62/20	43.25/110	-0.37×110	0.12	5	B	B	-0.50×105
		43.50/25	43.25/115	-0.25×115			B	B	
		43.50/25	44.00/115	-0.50×25	0	2	B	B	-0.50×60
		43.50/27	44.00/117	-0.50×27			B	B	
4. WW	26	41.75/3	43.25/93	-1.50×3	0	3	W	B	+4.00-1.00×175
		41.75/180	43.25/90	-1.50×180			B	B	
		42.00/10	43.00/100	-1.00×10	0	5	W	B	+4.00-0.50×180
		41.75/5	42.75/95	-1.00×5			B	B	
5. WC	30	40.00/167	39.75/77	-0.25×77	0	3	W	B	+0.75-0.37×90
		39.87/170	39.62/80	-0.25×80			W	B	
		39.50/108	39.87/18	-0.37×108	0.37	—	W	B	+1.00-0.25×90
		39.75	39.75	spherical			W	B	
6. AA	25	43.50/23	44.00/113	-0.50×23	0.12	1	W	B	+1.25 sph.
		43.37/22	43.75/112	-0.37×22			W	B	
		43.75/25	44.25/115	-0.50×25	0	5	W	B	+1.00 sph.
		43.62/20	44.12/110	-0.50×20			W	B	
7. VE	26	45.75/180	46.25/90	-0.50×180	0.25	0	B	B	+0.12-0.12×70
		45.75/180	46.00/90	-0.25×180			B	B	
		45.75/180	46.00/90	-0.25×180	0	0	B	B	+0.12-0.12×90
		45.75/180	46.00/90	-0.25×180			B	B	
8. DD	14	41.50/5	42.50/95	-1.00×5	0.25	—	B	B	+0.50-0.50×5
		41.25/5	42.50/95	-1.25×5			B	B	
		41.75/10	43.00/100	-1.25×10	0.12	0	B	B	+0.50-0.50×175
		41.37/10	42.50/100	-1.12×10			B	B	
9. DV	37	43.25/180	45.25/90	-2.00×180	0	0	B	B	-1.75-2.00×180
		43.50/180	45.50/90	-2.00×180			B	B	
		44.50/180	47.25/90	-2.75×180	0	0	B	B	-1.50-2.25×180
		44.75/180	47.50/90	-2.75×180			B	B	
10. WV	16	43.50/155	43.00/65	-0.50×65	0	3	B	B	-1.75-1.50×65
		43.50/152	43.00/62	-0.50×62			B	B	
		42.75/170	43.25/80	-0.50×170	0.25	0	B	B	-1.25-0.75×125
		42.75/170	43.50/80	-0.75×170			B	B	

TABLE 2—Continued

Pat.	Age	Double Readings*		Corneal Astigmatism	Differences		Exam- iner	In- stru- ment	Subjective Astigmatism
		Primary Meridian	Secondary Meridian		Amt.	Axis			
11. EL	44	44.50/180	41.00/90	-3.50×90			W	B	
		44.50/180	41.00/90	-3.50×90	0	0	W	B	+1.75-4.25×90
		42.62/30	43.12/120	-0.50×30			W	B	
		42.75/32	43.37/122	-0.62×32	0.12	2	W	B	-0.25-0.50×180
12. WG	43	42.75/15	43.50/105	-0.75×15			B	B	
		42.50/10	43.50/100	-1.00×10	0.25	5	B	B	+1.00-0.25×180
		42.50/175	43.50/85	-1.00×175			B	B	
		42.75/180	43.75/90	-1.00×180	0	5	B	B	+1.00-0.25×180
13. FP	21	42.75/10	43.87/100	-1.12×10			E	B	
		43.00/10	44.25/100	-1.25×10	0.12	0	B	B	+1.00-0.25×180
		42.37/5	44.00/95	-1.62×5			E	B	
		42.75/5	44.25/95	-1.50×5	0.12	0	B	B	+1.00-0.25×180
14. LB	11	40.50/180	43.00/90	-2.50×180			H	A	
		40.87/180	43.12/90	-2.25×180	0.25	0	W	B	+7.25-2.00×175
		40.00/7	43.50/97	-3.50×7			H	A	
		40.62/8	43.37/98	-2.75×8	0.75	1	W	B	+8.25-2.25×5
15. EK	48	43.50/7	45.00/97	-1.50×7			W	B	
		43.25/5	45.00/95	-1.75×5	0.25	2	B	B	+1.25-1.75×180
		43.50/175	45.50/85	-2.00×175			W	B	
		43.50/175	45.50/85	-2.00×175	0	0	B	B	+1.25-2.00×170
16. JW	10	43.00/10	44.00/100	-1.00×10			B	B	
		43.00/5	44.00/95	-1.00×5	0	5	B	B	+1.50-0.50×180
		43.25/175	44.25/85	-1.00×175			B	B	
		43.00/175	44.00/85	-1.00×175	0	0	B	B	+1.50-0.50×180
17. RE	51	44.25/15	45.00/105	-0.75×15			B	B	
		44.12/15	45.00/105	-0.87×15	0.12	0	B	B	+2.00-0.50×30
		44.75/15	45.00/105	-0.25×15			B	B	
		45.00/20	45.25/110	-0.25×20	0	5	B	B	+1.75-0.50×110
18. IG	53	43.75/180	44.25/90	-0.50×180			B	B	
		43.87/175	44.25/85	-0.37×175	0.12	5	B	B	-0.50-0.50×70
		43.75/180	44.00/90	-0.25×180			B	B	
		44.00/180	44.25/90	-0.25×180	0	0	B	B	-0.25-0.25×90
19. WW	30	44.37/165	44.87/75	-0.50×165			W	B	
		44.12/160	44.62/70	-0.50×160	0	5	W	B	+0.25-0.75×120
		44.62/60	45.12/150	-0.50×60			W	B	
		45.00/45	44.50/135	-0.50×45	0	15	W	B	+0.50-1.00×65
20. EM	37	44.50	44.50	spherical			W	B	
		44.75	44.75	spherical	0	—	W	B	+1.75-0.50×90
		43.87/20	44.12/110	-0.25×20			W	B	
		44.12/10	44.50/100	-0.37×10	0.12	10	W	B	+1.50-0.50×105
21. CP	50	43.25/2	46.62/92	-3.37×2			W	B	
		43.25/2	47.00/92	-3.75×2	0.37	0	B	B	0.00-4.50×178

TABLE 2—*Continued*

Pat.	Age	Double Readings*		Corneal Astigmatism	Differences		Exam- iner	In- stru- ment	Subjective Astigmatism
		Primary Meridian	Secondary Meridian		Amt.	Axis			
		44.37/173 44.25/176	47.25/83 47.25/86	-2.87×173 -3.00×176	0.12	3	W B	B B	-0.75-3.00×2
22. MH	35	42.25/30 42.50/32	44.50/120 44.50/122	-2.25×30 -2.00×32	0.25	2	B B	B B	+2.25-1.25×30
		42.50/155 42.25/152	44.50/65 44.37/62	-2.00×155 -2.12×152	0.12	3	B B	B B	+2.25-1.25×150
23. CM	60	44.50/164 44.37/165	44.75/74 44.62/75	-0.25×164 -0.25×165	0	1	W W	B B	+2.50-2.00×90
		44.62/180 44.62	44.75/90 44.62	-0.12×180 spherical	0.12	—	W W	B B	+1.75-0.75×110
24. EB	20	41.50/3 41.50/2	46.50/93 46.75/92	-5.00×3 -5.25×2	0.25	1	B B	B B	+1.00-4.00×3
		42.00/2 41.75/2	46.25/92 46.25/92	-4.25×2 -4.50×2	0.25	0	B B	B B	+1.00-3.00×177
25. FM	34	41.50/24 41.37/20	42.00/114 41.75/110	-0.50×24 -0.37×20	0.12	4	W W	B B	+1.00 sph.
		41.50/7 41.37/6	42.12/97 42.37/96	-0.62×7 -1.00×6	0.37	1	W W	B B	+1.50-0.25×130
26. RF	44	41.00/180 41.50/170	40.50/90 40.50/80	-0.50×90 -1.00×80	0.50	10	M M	C C	-0.25-1.25×80
		41.00 41.00/180	41.00 40.75/90	spherical -0.25×90	0.25	—	M M	C C	-0.62-0.75×90
27. HR	41	43.75/7 43.75/6	46.00/97 46.00/96	-2.25×7 -2.25×6	0	1	B B	B B	+1.75-2.00×8
		44.00/174 43.87/174	45.25/84 45.12/84	-1.25×174 -1.25×174	0	0	B B	B B	+1.50-1.00×170
28. KK	52	41.25/140 41.00/138	42.75/50 42.62/48	-1.50×140 -1.62×138	0.12	2	B B	B B	+1.00-2.00×135
		41.12/30 41.00/32	42.62/120 42.62/122	-1.50×30 -1.62×32	0.12	2	B B	B B	+1.25-1.75×30
29. HW	43	43.50/180 43.50/2	44.25/90 44.25/92	-0.75×180 -0.75×2	0	2	B B	B B	0.00-0.25×120
		43.75/177 43.75/180	44.75/87 44.75/90	-1.00×177 -1.00×180	0	3	B B	B B	0.00-0.25×40
30. RC	31	41.75/2 42.00/3	44.12/92 44.50/93	-2.37×2 -2.50×3	0.12	1	W B	B B	+1.75-2.25×4
		42.25/7 42.25/2	44.50/97 44.75/92	-2.25×7 -2.50×2	0.25	5	W B	B B	+2.00-2.00×176
31. AC	26	44.25/180 44.12/180	44.75/90 44.87/90	-0.50×180 -0.75×180	0.25	0	B B	B B	0.00

TABLE 2—Continued

Pat.	Age	Double Readings*		Corneal Astigmatism	Differences		Exam- iner	In- stru- ment	Subjective Astigmatism
		Primary Meridian	Secondary Meridian		Amt.	Axis			
		44.00/180	45.25/90	-1.25×180			B	B	
		44.00/180	45.25/90	-1.25×180	0	0	B	B	0.00
32. LP	35	43.12/90	43.62/180	-0.50×90			W	B	
		42.87/100	43.12/10	-0.25×100	0.25	10	W	B	+1.00-1.00×90
		43.62/180	43.25/90	-0.37×90			W	B	
		43.25	43.25	spherical	0.37	—	W	B	+1.00-1.00×80
33. PB	19	43.87/180	44.00/90	-0.12×180			W	B	
		44.00	44.00	spherical	0.12	—	W	B	-0.25-0.25×100
		44.37/180	44.62/90	-0.25×180			W	B	
		44.25/180	44.75/90	-0.50×180	0.25	0	W	B	-0.50-0.12×75
34. JD	56	42.25/6	43.75/96	-1.50×6			W	B	
		40.62/180	42.25/90	-1.62×180	0.12	6	T	C	+1.50-0.62×175
		42.50/22	43.87/112	-1.37×22			W	B	
		41.25/10	42.50/100	-1.25×10	0.12	12	T	C	+2.00-1.00×30
35. PD	12	42.87/22	45.00/112	-2.12×22			W	B	
		42.87/19	44.87/109	-2.00×19	0.12	3	W	B	-13.00-3.00×30
		42.00/1	45.75/91	-3.75×1			W	B	
		41.87/2	45.37/92	-3.50×2	0.25	1	W	B	-8.00-5.00×170
36. EM	20	44.62/35	45.00/125	-0.37×35			W	B	
		44.50/38	44.62/128	-0.12×38	0.25	3	W	B	+0.50 sph.
		44.62/10	45.00/100	-0.37×10			W	B	
		44.37/15	44.87/105	-0.50×15	0.12	5	W	B	+0.75 sph.
37. JS	19	44.50/5	45.75/95	-1.25×5			B	B	
		45.00/10	46.37/100	-1.37×10	0.12	5	W	B	+0.50 sph.
		44.50/10	45.75/100	-1.25×10			B	B	
		44.75/20	45.87/110	-1.12×20	0.12	10	W	B	+0.50 sph.
38. KG	8	42.50/5	43.50/95	-1.00×5			H	?	
		42.75/180	43.62/90	-0.87×180	0.12	5	W	B	+2.75-0.50×180
		42.50/180	44.00/90	-1.50×180			H	?	
		42.75/6	44.25/96	-1.50×6	0	6	W	B	+2.75-1.00×180
39. CM	52	45.25/7	48.00/97	-2.75×7			W	B	
		44.75/7	46.25/97	-3.00×7	0.25	0	W	B	+0.50-1.25×168
		44.50/180	47.50/90	-3.00×180			W	B	
		44.50/1	47.25/91	-2.75×1	0.25	1	W	B	+1.00-1.25×10
40. HL	58	42.87/26	44.12/116	-1.25×26			W	B	
		43.00/30	44.12/120	-1.12×30	0.12	4	W	B	-0.25-1.50×40
		41.62/14	43.00/104	-1.37×14			W	B	
		41.50/16	42.62/106	-1.12×16	0.25	2	W	B	+0.50-0.50×180
41. ID	19	44.75/15	47.75/105	-3.00×15			B	B	
		44.50/15	47.50/105	-3.00×15	0	0	B	B	-0.50-2.50×17

TABLE 2—Continued

Pat.	Age	Double Readings*		Corneal Astigmatism	Differences		Exam- iner	In- stru- ment	Subjective Astigmatism
		Primary Meridian	Secondary Meridian		Amt.	Axis			
42. EF	22	44.50/160	48.00/70	-3.50×160	0.12	1	B	B	+0.50-3.00×155
		44.25/161	47.62/71	-3.37×161			B	B	
		42.50/16	43.00/106	-0.50×16	0	3	W	B	+0.25-0.25×80
		42.75/13	43.25/103	-0.50×13			W	B	
43. GB	24	42.75/9	43.25/99	-0.50×9	0.25	1	W	B	+0.25-0.25×100
		42.75/10	43.50/100	-0.75×10			W	B	
		43.50/14	44.00/104	-0.50×14	0.12	6	W	B	+1.00-0.25×85
		43.62/20	44.25/110	-0.62×20			W	B	
44. WL	27	43.25/12	44.25/102	-1.00×12	0.37	4	W	B	-0.25-0.50×120
		43.25/16	43.87/106	-0.62×16			W	B	
		43.50/3	47.75/93	-4.25×3	0	1	B	B	+3.00-3.50×2
		43.25/4	47.50/94	-4.25×4			B	B	
45. VO	48	43.50/2	48.00/92	-4.50×2	0	0	B	B	+2.75-3.00×2
		43.75/2	48.25/92	-4.50×2			B	B	
		44.00/170	42.00/80	-2.00×80	0	3	B	B	-1.50-3.00×83
		44.25/172	42.25/85	-2.00×83			B	B	
46. RL	21	44.25/20	43.75/110	-0.50×110	0	10	B	B	+1.75-0.50×110
		44.25/30	43.75/120	-0.50×120			B	B	
		42.87/22	43.37/112	-0.50×22	0.12	0	W	B	+0.50 sph.
		42.87/22	43.25/112	-0.37×22			W	B	
47. MH	40	42.62/7	43.37/97	-0.75×7	0	1	W	B	+0.50 sph
		42.62/8	43.37/98	-0.75×8			W	B	
		42.75/5	43.50/95	-0.75×5	0.25	5	W	B	+0.50-0.50×180
		42.62/180	43.62/90	-1.00×180			W	B	
48. JB	17	42.50/15	43.50/105	-1.00×15	0.12	5	W	B	+0.50-0.50×180
		42.37/10	43.50/100	-1.12×10			W	B	
		41.12/180	43.12/90	-2.00×180	0.25	2	W	B	-1.00-0.75×160
		41.00/2	42.75/92	-1.75×2			W	B	
49. RW	55	40.75/4	43.50/94	-3.25×4	0	1	W	B	+3.25-3.25×5
		40.12/5	43.37/95	-3.25×5			W	B	
		43.00/180	43.12/90	-0.12×180	0.12	10	T	C	+1.00-1.00×90
		44.00/10	44.25/100	-0.25×10			W	B	
50. RR	24	42.75/180	43.50/90	-0.75×180	0.12	5	T	C	Plano
		43.62/5	44.25/75	-0.62×5			W	B	
		44.00/180	43.87/90	-0.12×90	0.12	—	W	B	-1.75-0.25×35
		43.87	43.87	spherical			W	B	
		43.87/33	44.12/123	-0.25×23	0.12	5	W	B	-1.50 sph.
		43.75/28	44.12/118	-0.37×28			W	B	

* For each case, the first two readings are for the right eye and the second set of two readings is for the left eye. The readings in the primary and secondary meridians are given and these meridians are noted by the figures following the slanted (/) line.

ship between the absolute amount of corneal astigmatism measured and the repeatability of the readings. The 34 cases in which there was no difference in amount between the repeated readings averaged 1.36D. of corneal astigmatism. The eight patients who had a maximum difference between readings (0.37D. or more) averaged 1.38D. of corneal astigmatism. That is, the amount of astigmatism measured was essentially the same in these two categories and was also substantially the same as the grand average of amount (1.32D. cyl.) of astigmatism for the 100 eyes. The repeatability of keratometric readings relative to the

TABLE 3

REPEATABILITY OF KERATOMETRIC READINGS AS TO AMOUNT

Difference in Amount diopeters	Number of Cases	Cumulative Percentage of Cases
0.00	34	34
0.12	34	68
0.25	24	92
0.37	5	97
0.50	2	99
0.62	0	99
0.75	1	100

amount of astigmatism measured, is therefore independent of the total amount of astigmatism.

A similar attempt was made to find the relationship between the repeatability of axis determinations and the absolute amount of astigmatism measured. The results are given in table 5.

Since the axis position in seven cases of spherical corneas was indeterminate, these cases were excluded from this distribution. It is apparent from a study of the table that the lower the amount of corneal astigmatism the less repeatable are the axis determinations.

In analyzing the results by examiners and instruments the data have been classified into three groups:

TABLE 4

REPEATABILITY OF KERATOMETRIC READINGS AS TO AXIS

Difference in Axis degrees	Number of Cases	Cumulative Percentage of Cases
0	33	33
1	14	47
2	9	56
3	10	66
4	3	69
5	18	87
6	3	90
7	0	90
8	0	90
9	0	90
10	6	96
11	0	96
12	1	97
13	1	98
14	1	99
15	1	100

1. The repeated measurements in 36 eyes were taken by examiner B with instrument B*.
2. The repeated measurements in 38 eyes were taken by examiner W with instrument B*.
3. The repeated measurements in 26

TABLE 5

REPEATABILITY OF AXIS DETERMINATIONS RELATIVE TO THE AMOUNT OF KERATOMETRIC ASTIGMIA

Difference Between Repeated Axis Readings degrees	Number of Cases Included	Average Amount of Corneal Astigmatism diopeters
0-2	49	1.84
3-4	13	1.18
5-6	21	0.87
7-9	0	—
10 and over	10	0.78

eyes were taken by a combination of the six examiners; that is, either both repeated reading were taken by examiners E, H, M, or T, or one reading was taken by one of the six

* Examiners B and W had an instrument of type B in their refracting rooms and therefore used it consistently.

examiners and the other readings by another examiner. In this last category the readings were taken with either one of the three instruments: A, B, C.

The results of this analysis are summarized in table 6.

TABLE 6
ANALYSIS OF RESULTS BY EXAMINERS AND INSTRUMENTS

Examiner	Number of Eyes	Instrument	Average Deviation
B	36	B	0.09
W	38	B	0.14
All	26	All	0.20

The average deviations between repeated readings varied in the different categories from the total average deviation (0.14D.) by ± 0.06 D. There was a small variation between the readings taken by different examiners on the same instrument, indicating that the variations are not due to the different instruments. One can conclude, therefore, that keratometric readings are influenced only to a very small degree by the discriminative ability of the examiner.

It was thought that the slight variations in repeated readings were due to involuntary movements of the patients' eyes. Therefore, repeated readings were taken on an artificial (glass) cornea* having an astigmatism of 1.62D., which was rigidly mounted before the keratometer. The repeatability of successive readings taken by examiners B and W on the glass cornea showed variations similar in amount and in axis to those found on human subjects. This would indicate that movements on the part of the patients did not account for the variations found in this study.

* We are indebted to F. W. Jobe of the Bausch & Lomb Optical Company, who kindly loaned us the glass cornea and attachments for mounting it before the keratometer.

SUMMARY AND CONCLUSIONS

1. The analysis of repeatability tests on the keratometer indicates that these readings are quite repeatable in determining the amount and axis of the corneal astigmatism.

2. In rare cases the difference in amount between repeated keratometric measurements may be relatively high. In this study of 100 eyes there was one case with a difference between repeated readings of 0.75D. In the majority of cases (92 percent) the deviation was 0.25D. or less.

3. Similarly, in a few cases the difference in axes between repeated keratometric readings was as high as 15° , but in the majority of cases (87 percent) the difference was 5° or less.

4. No relationship was found between the total amount of corneal astigmatism and the repeatability of the amount of the readings.

5. On the other hand, there was a definite relationship between the total amount of corneal astigmatism and the repeatability of the axis readings. That is, the higher the amount of corneal astigmatism the more dependable were the axis determinations.

6. This study of the repeatability of keratometric readings on 100 eyes indicates that the keratometer is a reliable instrument for the measurement of corneal curvatures and that the importance of the interpretation of individual examiners is negligible. The stability of the corneal curvatures is verified by the constancy of repeated readings.

7. The role of the keratometric readings in the eventual diagnosis and therapy, although difficult to analyze, is important because one can be guided by the accuracy and consistency of corneal curvatures and interpret changes in subjective refraction in terms of factors other than the cornea.

Significant differences in subjective refraction not substantiated by changes in corneal curvature must indicate lenticular or indicial changes. This information may be of diagnostic value.

8. Since the cornea constitutes four fifths of the refracting power of the eye, since its front surface can be *accurately*

measured by the keratometer, and since changes or lack of changes in its curvature may have diagnostic importance, it seems worthwhile to recommend the keratometer as an important adjunct to the battery of instruments and techniques used in refractive measurements.

4 Webster Avenue.

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NOTES, CASES, INSTRUMENTS

A CASE OF MULTIPLE TUBERCULOUS NODULES OF THE EPISCLERA*

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Episcleritis and scleritis of a tuberculous origin are rare diseases. American literature does not contain many reports of these lesions; most of them are to be found in the foreign literature.

The question as to whether these lesions, which are nodular in appearance, are scleral or episcleral frequently cannot be answered. The site of origin is most probably in the episcleral tissue, and as the nodule increases in size, it begins to involve the conjunctiva and the outer and middle layers of the sclera. There are many transitional forms, which can involve the sclera alone or the episcleral tissue to a lesser or greater degree. Many investigators believe that in cases of deep tuberculous scleritis there must be uveal involvement. Pollack¹ has reported a case of an isolated tubercle of the sclera without involvement of the uvea. Many of the German authors write of tuberculous conjunctivitis and episcleritis, because of their feeling that the two cannot be separated.

The question as to whether these nodules are primary tuberculous infections or secondary in nature has been discussed at length by Schieck,² Junius,³ Davids,⁴ and others. Schieck, in considering the mode of origin of tuberculosis of the conjunctiva and episclera, came to the following conclusions on the basis of the work of Ranke and Igersheimer⁵: (1)

*From the Eye Service of the Gouverneur Hospital. Presented before the New York Society for Clinical Ophthalmology, on February 5, 1945.

That the tubercle bacillus can penetrate the conjunctiva without causing a lesion in it. (2) That the diagnosis of primary tuberculosis of the conjunctiva requires a swelling of the regional lymph nodes. (3) That those cases of tuberculosis of the episclera without such swelling must be considered endogenous or secondary in nature.

Most other authors believe these lesions to be secondary in nature. Krückmann⁶ also stated that tuberculosis of the eye is rarely associated with tuberculosis of the lung, but is frequently associated with tuberculosis of the thorax and abdomen. It is a well-known fact that in tuberculosis sanatoria, where patients with active lung lesions are found, there are exceptionally few cases of ocular tuberculosis.

Most reports in the literature deal with individual tuberculous nodules; Duke-Elder⁷ noted several nodules forming intermittently; and Schultz⁸ has reported a case of multiple nodules of the conjunctiva and episclera. The last named writer excised one of the nodules and found it to be typical tuberculous granulation tissue, but no tubercle bacilli were found. In this case the nodules became confluent and then ulcerated. The entire area was then covered with connective tissue. The patient showed old corneal opacities of both eyes. X-ray studies of the chest showed a tuberculous lesion on the right side.

In determining the differential diagnosis, the following conditions must be considered:

1. Phlyctenular conjunctivitis. This is distinguished by a nodule in the conjunctiva which is surrounded by conjunctival vessels. It is not painful on palpation and is associated with some form of dietary deficiency.

2. Episcleritis associated with rheuma-

toid arthritis, the lesions of which are single with a superficial vascularization usually near the limbus. The patient complains of pain, photophobia, and lacrimation. There is a history of rheumatoid arthritis.

3. Anterior scleritis is a diffuse swelling of the anterior segment of the globe, more extensive than the nodules of episcleritis. Several nodular areas fuse, until in the worst cases the inflammation extends entirely around the cornea to form an annular scleritis.

4. Lymphoma of the conjunctiva is characterized by a transparent edematous mass which is not nodular in appearance. It occurs in the subconjunctival tissue and is frequently associated with hyperplasia of the lymphoid and blood-forming tissues.

5. Gelatinous or brawny scleritis is a diffuse swelling of the sclera which may hang down over the cornea. It has a gelatinous and succulent appearance. Eventually it infiltrates the cornea and opacifies it. It is frequently associated with more or less severe uveitis.

The case reported here is one of multiple tuberculous nodules of the episclera and sclera.



Fig. 1 (Kronenberg). Multiple tuberculous nodules of the episclera.



Fig. 2 (Kronenberg). Photomicrograph of section through a tuberculous nodule. $\times 125$.

D. K., a white woman, aged 64 years, had noticed in April, 1944, that the upper part of the right eye was inflamed and painful. There was no photophobia, and no discharge (fig. 1). At the age of 3 years both eyes had been inflamed after an attack of measles. Her general condition at present (blood pressure, urinalysis, and Wassermann test) were within normal limits. The chest, however, gave evidence of an active tuberculous lesion in the left upper lobe of the lung.

Ocular findings: Vision O.D. was 20/100; O.S., 20/400. The conjunctiva below was clear. In the area involved there was an edema of the conjunctiva with dilation and engorgement of the conjunctival vessels. Under the conjunctiva there were several small yellowish nodules.

The cornea of the right eye, centrally, presented an old opacity, localized under the epithelium. At the 4- and the 2-o'clock positions there were infiltrates extending from the limbus for 2 mm., with conjunctival vessels going to them. In the left eye also a central large opacity was localized under the epithelium, but contained

no vessels. Nasally there were some vessels going from the limbus.

The fundi were not clearly observable.

One of the nodules was excised and the pathologic report as given by Dr. A. Sala follows:

"The lesion consists of a central mass of necrotic tissue, caseous material, and fragments of nuclei here and there. This central debris is surrounded by some epithelioid cells and lymphocytes. One or two giant cells are to be seen. The histologic diagnosis is tuberculosis. Stains for tubercle bacilli were negative, but the histologic examination is characteristic of a tuberculous lesion" (fig. 2).

At present the patient is beginning to show signs of a thinning of the sclera in the area involved and exhibiting the char-

acteristic bluish color. She is receiving tuberculin therapy.

This case is reported because of the following unusual features:

1. There are few reports of multiple nodules of this nature.

2. Its association with an active lung lesion demonstrates the fact that it is metastatic in nature. This adds to the evidence that is accumulating that these lesions are secondary in nature.

3. A biopsy specimen was obtained so that the diagnosis of a tuberculous lesion could be established on a histologic basis.

4. This case demonstrates that deep tubercular scleritis can occur without involvement of the uvea.

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A TENDON-TRANSPLANTATION TECHNIQUE FOR EXTERNAL- RECTUS PARALYSIS*

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Because of the medial origin of both the superior and inferior recti, and because of the attachment of a part of their tendons nasal to the vertical meridian of the eyeball; a subsidiary function of these muscles is internal rotation. In external-

rectus paralysis, transplantation of the whole of the vertical-rectus tendons to a position temporal to the median vertical plane largely converts the internal rotation of these muscles into the more desirable action of external rotation. O'Connor¹ has achieved this in three ways: (1) by laying the inner halves of the vertical-rectus tendons over the lateral halves; (2) by transplanting the whole; or (3) by transplanting the inner halves of the vertical-rectus tendons to the corresponding borders of the external rectus.

The following technique is also a successful means of applying this principle to external-rectus paralysis (fig. 1). The

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external rectus is resected but not immediately reattached to the sclera. Through the same conjunctival incision the vertical-rectus muscles are exposed one at a time. Their tendons are split in the middle with a sharp hook, and the muscle is divided back for an additional 10 mm. with scissors. The outer muscle slip thus formed is transplanted to the sclera behind the insertion of the external-rectus muscle. The inner muscle slip is transplanted to the position previously occupied by the outer muscle slip. The resected external rectus is replaced to its original attachment. Most cases of external-rectus paralysis are not treated surgically until complicated by some degree of internal-rectus contracture. A recession upon this muscle can usually be done to advantage.

The vertical recti can be split back as far as possible without injury to their innervation because the nerves enter these muscles at the junction of the posterior and middle thirds. The transplanted muscle slips ride smoothly across the sclera without excessive tension. By means of the new attachment of the vertical recti, a strong action of external rotation opposes the internal rectus.

Case 1. A girl, aged nine years, had congenital bilateral external-rectus paralysis and a 30-degree left internal strabismus. Vision: R.E. 6/7.5-3; L.E. 6/12-1.

A strong left internal rectus was recessed 5.5 mm. The external rectus was resected 6 mm. The outer three fifths of the vertical recti were transplanted to a point behind the insertion of the external rectus; the nasal tendon slips were moved to the outermost insertions of the vertical recti. Postoperatively, 14 degrees of right hypertropia and 20 degrees of exotropia existed. The left eye could be rotated 48 degrees externally. Two months after the

first operation, the left internal rectus was advanced 5 mm. I did not see this patient again, but when seen in the same clinic two months following the last operation, she was reported to have 6 degrees of exophoria and some right hyperphoria. Internal rotation for the left eye was 40

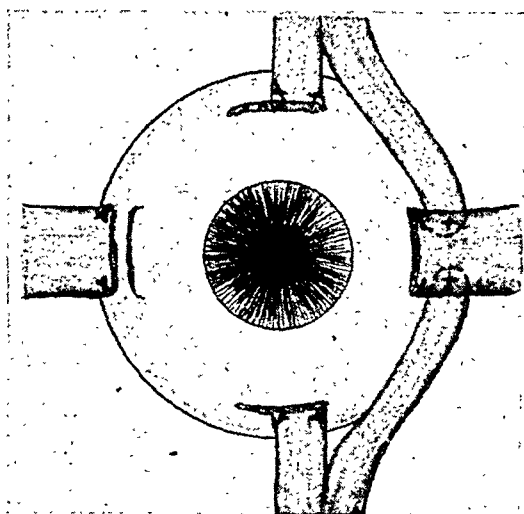


Fig. 1 (Lutman). Tendon transplantation technique for external-rectus paralysis.

degrees and external rotation 35 degrees.

Case 2. A girl, aged 17 years, was semi-comatose for a week following a motorcycle accident in June, 1943. Skull X-ray studies at the time revealed no fracture. Upon regaining consciousness the patient had no sensation on the left side of her face, and her left eye was nearly blind. She could not rotate the right eye externally to the midline. Nine months after the accident, when I first saw her, the left side of her face was hyperesthetic. No tears were shed from either eye when she "cried." Vision was: R.E. 6/7.5+3; L.E. the perception of fingers at one foot. The optic disc of the left eye was chalky white from primary atrophy. The patient's head was constantly rotated far to the right. External rotation of the right eye was limited to 18 degrees nasal to the midline.

Ten months after the accident, with the patient under a general anesthesia, the right eye could be rotated outward with the aid of tissue forceps against a moderate amount of resistance from the contracted internal rectus. The internal rectus was recessed 4 mm. The external rectus was resected 5 mm. The outer halves of the vertical recti were transplanted to a

point behind the insertion of the external rectus. The inner halves of the vertical recti were transplanted to the normal attachment of the outer halves of these muscles. Postoperatively, the eyes were straight in the primary position without head rotation. The right eye could be rotated externally 23 degrees.

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SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE

ROYAL SOCIETY OF MEDICINE

SECTION OF OPHTHALMOLOGY

November 9, 1944

MR. P. E. H. ADAMS, *president*

Abstracted by permission from the Proceedings of the Royal Society of Medicine (Section of Ophthalmology), 1945, volume 38, no. 2, sectional page 11.

AN INSTRUMENT FOR TESTING DARK ADAPTATION

MR. E. W. GODDING presented a paper on this subject and described in various stages the apparatus used in measuring dark adaptation.

STUDIES IN DARK ADAPTATION IN THE DETECTION OF DEFICIENCY OF VITAMIN A

CAPTAIN JOHN YUDKIN, RAMC, presented a paper on this subject summarized as follows:

(1) If vitamin A affects any part of the dark-adaptation curve, it always affects the final rod threshold; other parts of the curve may or may not be affected. It follows that if only one point in the

curve is to be measured it should be the final rod threshold.

(2) In order to prove the existence of vitamin-A deficiency by measuring dark adaptation, it is necessary to apply the therapeutic test; that is, to see whether the dark adaptation is improved after the administration of the vitamin.

(3) Although the therapeutic test is essential in order to detect deficiency in an individual and desirable in groups, it is not always practicable to apply it to groups. In this case, presumptive evidence of deficiency may be obtained by comparing the dark adaptation of different groups.

(4) Since age affects dark adaptation, it is necessary either to allow for this in comparing groups of different ages or to compare groups of similar age.

Discussion. Dr. H. Pollak, Major R. E. Wright, Dr. W. D. Wright, Mr. D. V. Giri, Mr. F. A. Juler, Dr. Z. A. Leitner, Dr. H. S. Stannus, and Mr. E. W. Godding discussed this paper.

THE HERBERT IRIS-INCARCERATION METHOD OF OPERATION FOR GLAUCOMA

DR. MARY CRIPPS gave a demonstra-

tion of the visual fields before and after operation. She had used the Herbert iris-incarceration method in 306 cases, and the following were her conclusions as to the result.

I. Glaucoma with tension ranging from normal to 70 mm. Hg (Schiøtz)

In those cases of chronic glaucoma whether or not an acute or subacute attack has been superimposed on the chronic state, and if the tension varies from 25 mm. Hg to 70 mm. Hg (Schiøtz) and can be reduced (by appropriate methods) down to about normal, and if the field of vision varies from a sickle-shaped scotoma and peripheral depression (early stages) down to the more advanced stages of a restricted field and sloping-edged defects with depression of central vision—provided that not more than half of the fixation area within the 5-degree circle has been invaded—then the vision improves with the Herbert operation.

II. Glaucoma with tension above 70 mm. Hg

Included under this heading are those cases, whether suddenly acute or ordinarily chronic, wherein the tension has risen above 70 mm. Hg and can be reduced by intravenous glucose to normal limits but which rapidly rises again, and wherein the vision is reduced.

(a) In those cases wherein more than half of the fixation area has been invaded and there are doubtful areas of vision, the operation gives only relief from pain and tension, and the vision is liable to deteriorate.

(b) In those cases wherein vision is reduced to perception of light in the upper temporal quadrant the Herbert operation gives increased vision in this quadrant with reduction in tension to normal limits.

However, in these cases the operation must be modified, the edges of the incision are punched with a Lagrange punch be-

fore the fibrotic strands of the permanently dilated iris can be incarcerated.

Sclerosis of the lens which may exist in these cases of prolonged tension is inclined to increase but as soon as the sclerosis has progressed sufficiently the lens is easily removed because the gap in the iris already exists and the fibrosed iris tissue of the filtering scar lies deep to the cataract incision. The wound heals normally without subsequent increase of tension.

RETINIS CIRCINATA OF UNKNOWN ORIGIN IN A CHILD

MR. O. GAYER MORGAN presented an eight-year-old boy. His mother said he had complained of difficulty in reading. The vision was R.E. 6/18; L.E. 6/5. The fundus showed very marked retinitis circinata, with a small reddish or orange central spot which was just above the macula. The only relevant history was that he had had concussion a year previously, was bruised on the right side of his face, and the eye was closed. He was entirely healthy except that he suffered from asthma. He had a very large head, which might denote a mild degree of hydrocephalus, but it was a family trait to have large heads. His eye condition, presumably, was one of edema and hemorrhages, and it might have been considered a case of early Coats's disease; however, contraindications were that there were no engorged or large vessels, or angiomatous-looking enlargements, no deep swelling, and no detachment. It might have been a hemorrhagic condition as a result of the fall, but it was a little difficult to see how it could cause such retinitis circinata. It might have been one of those types of edema of the retina, usually unilateral, which occurs in children or young people for no apparent reason, and in which no actual cause of the process can be found. Mr. Morgan was anxious to know

whether anyone had seen anything like this before.

Discussion. Mr. Adams said that he presumed it might have been traumatic if, as a result of concussion, he had extensive choroidal hemorrhage with damage to the macula, the retinitis having developed subsequent to that.

QUESTIONABLE CONJUNCTIVAL EPITHELIOMA. QUESTIONABLE ATYPICAL MOOREN'S ULCER SUPERIMPOSED ON OLD MUSTARD-GAS DAMAGE

MR. ALAN HOLMES-SMITH presented a man, aged 60 years. There was a history of damage to the left eye by mustard gas in 1918. At that time he was hospitalized and treated for three months. During the past two or three months the lids of the left eye had become swollen. The swelling receded with the use of hot compresses. For three weeks prior to this examination there was ptosis of the left eyelid.

The vision was R.E. 6/24, L.E. ability to count fingers.

The right eye was normal on examination. The left eye showed an inactive pupil and no red reflex. The tension was normal. There was a firm raised area of conjunctiva below and medial to the limbus, extending into the lower fornix; the edge was raised. The lower nasal quadrant of the cornea was involved in the lesion, and an opaque area separated it from normal cornea. No enlarged glands were palpable in the neck.

Mr. Holmes-Smith said that there was some difference of opinion as to the diagnosis, whether it was an atypical Mooren's ulcer or a new growth. It was finally decided to enucleate the eye, and that was done completely with as much conjunctiva as could be taken from the lower fornix. On section the tumor was thought to be an epithelioma with considerable inflammatory reaction, with the sclera

undergoing invasion at the limbus. A course of radiotherapeutic treatment has been advised.

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

December 4, 1944

DR. MILTON L. BERLINER, *presiding*

✓ SYPHILITIC OPTIC ATROPHY AND TRYPARSAMIDE AMBLYOPIA

DR. H. HOUSTON MERRITT said that syphilitic optic atrophy may be secondary to meningeal involvement of the nerve or luetic chorioretinitis, but more frequently it is primary. Primary luetic optic atrophy may be the only manifestation of the disease, although more frequently it is seen with tabes dorsalis. The exact pathogenesis is not clearly elucidated but it is probably due to primary involvement of the nerve itself or its blood vessels by the disease. Spirochetes have been found pathologically in only two cases, both by Igersheimer. The characteristic visual defect consists of loss of central field with concentric or sector-shaped peripheral constriction. The course is progressively downhill and if one eye is involved the other may be expected to show the same condition within seven years. Useful vision may likewise be expected to be lost within seven years after the condition is recognized. Until recent years treatment has been ineffective, whether in the form of trivalent arsenicals, tryparsamide, or the Swift-Ellis method of arsenical treatment. Fever therapy is accepted today and if instituted sufficiently early, offers a 60-percent chance of arresting the condition. Penicillin has not been in use for a long enough period of time to determine its usefulness.

✓ Optic atrophy may be caused by tryparsamide. It is known that other pentavalent arsenicals have an affinity for the

optic nerve in experimental animals. It has been found that 8 percent of patients under tryparsamide treatment experience some visual phenomenon. In half of these patients this is purely subjective and not serious. A few hours after the injection the patient's vision is blurred for several hours by a shining mist, such as may be seen over a hot radiator. This will not recur if the tryparsamide is discontinued, but if the drug is continued blindness can develop with the fundus appearing normal. This blindness improves later with the return of central vision, but the visual field continues to be of a funnel type. Atrophy becomes detectable after several weeks. This visual disturbance usually occurs after the first few tryparsamide injections and is unusual, but possible, after the eighth injection.

Although it has been claimed that the tryparsamide does not directly induce the blindness but lights up syphilis already in the eye, the great speed of the appearance of the blindness (three hours) indicates that the drug itself is at fault. Also, there have been cases of blindness after tryparsamide administration to nonsyphilitic individuals. When tryparsamide is administered there are three safeguards against these complications: (1) ophthalmoscopic and visual-field examinations are performed to weed out abnormal cases, as these show 10 times the frequency of the complications; (2) only small doses should be administered at first; and (3) be on the alert for subjective symptoms.

Discussion. Dr. James W. Smith thought that Dr. Merritt stressed a point of practical importance regarding the poor visual prognosis in tabes either with or without therapy. If the inexperienced ophthalmologist fails to recognize this, he will be blamed by the patient for authorizing a therapy that induced blindness. Close coöperation is essential between the syphilologist and eye physician before

therapy with tryparsamide is started. Unfortunately, in some cases wherein there is vision and field loss other systemic disease may contraindicate fever therapy. Unless penicillin is proved effective against cerebrospinal syphilis, the doctor will still be confronted with a dilemma.

Dr. Merritt thanked Dr. Smith for re-emphasizing the importance of close co-operation between the ophthalmologist and syphilologist in the treatment of these cases of optic atrophy. Although some claim that all patients with syphilitic optic atrophy will be blind within seven years, he said that he did not believe that this was necessarily true. It is probable that some cases come to a spontaneous arrest. He did not believe justified the feeling of some ophthalmologists and syphilologists that tryparsamide can be used in the treatment of patients with optic atrophy. At the present time fever treatment is the method of choice. When using tryparsamide in the treatment of neurosyphilis, one should be very careful to watch for the development of visual symptoms, as it is a powerful and dangerous weapon.

INVOLVEMENT OF THE OCULAR SYSTEM IN DEMYELINATING DISEASES

DR. ARMANDO FERRARO presented a table summarizing the most important manifestations of involvement of the ocular system in various types of demyelinating diseases; such as multiple sclerosis, diffuse sclerosis, Schilder's disease, Devic's disease, Baló's disease, Krabbe's disease, and so forth.

He attempted to establish that from the clinical as well as the pathologic standpoint, all these various supposedly clinico-pathologic entities are nothing else but variants of the same fundamental process of demyelination of the central nervous system, in relation to age at onset, resistance of the individual, and virulence of the pathogenic factor.

He attempted further to make a comparison between the most important features of the histopathologic process of the various demyelinating diseases with the main features of allergic reaction of the brain. The material for such a comparison came from the Department of Neuropathology of the New York State Psychiatric Institute where since 1940 Dr. Ferraro, first in collaboration with Jervis, and then with the Kopeloffs, investigated the reaction of the nervous tissue to experimental allergy. Briefly, the essential features of experimental allergy, such as demyelination, vascular infiltration—first with polymorphonuclear cells and then with lymphocytes and histiocytes—reactive pliosis, presence of edema, occasional hemorrhages, presence of granulomatous-like formation with giant cells, occasional thrombi of small blood vessels, and occasional endarteritis, are all features which may be found in the so-called demyelinating diseases.

Dr. Ferraro drew the conclusion that the pathology of the demyelinating diseases including the pathology of the ocular system may be viewed also in the light of an allergic reaction.

Discussion. Dr. Daniel Kravitz said that ophthalmologists are dismayed by the large number of names which describe apparently similar conditions. The situation is analogous to the practice of attaching names to every corneal spot which appears somewhat different from the others. Regarding the possible allergic basis for the causation of the demyelinating diseases, Dr. Kravitz believed it too great a simplification. Here again one is reminded of the variety of ocular conditions explained by some as due to a single cause, vasoconstriction. Allergy as a cause for the demyelinating diseases does not explain the large number of familial cases in which patients reach a certain station in life and then are attacked by these diseases.

TOPICAL DIAGNOSIS OF DISTURBED OCULOMOTOR MOTILITY

DR. ALFRED KESTENBAUM differentiated between types of palsy of muscles supplied by the oculomotor nerve:

(1) Nuclear type: The arrangement of the centers for the individual eye muscles in the third-nerve nucleus is still controversial but it is more or less accepted that the cranial (superior) part represents the homolateral levator and superior rectus. Below these centers is the center for the inferior oblique of the same side. The inferior part of the nucleus and the neighboring trochlear nucleus represent the contralateral inferior rectus and superior oblique, respectively, and their fibers must cross the midline. The medial rectus is represented in the medial parts of both oculomotor nuclei. Briefly, the elevators have their centers homolaterally, the depressors contralaterally, and the medial rectus bilaterally. Owing to this complex arrangement a single focus in the nucleus cannot involve all the muscles supplied by the oculomotor nerve of one eye, and complete oculomotor palsy of one eye excludes a nuclear lesion. Partial oculomotor palsy is more frequent if the lesion is nuclear than if it is subnuclear. Bilateral paresis of single muscles indicates a nuclear lesion.

(2) Dorsal fascicular type: A lesion here, usually accompanied by involvement of the nucleus ruber or of the substantia nigra, shows also a disturbance of the tonus, muscular coördination, and sometimes sensibility of the opposite half of the body. This corresponds to the old "Benedict's syndrome," oculomotor palsy, and crossed hemitremor.

(3A) Ventral fascicle type: Here a lesion is usually associated with a pyramidal-tract lesion in the pes pedunculi, resulting in Weber's syndrome, oculomotor palsy, and crossed hemiplegia.

(3B) Root type: A lesion of the root

of the third nerve, after it leaves the brain stem at the medial side of the peduncle, also results in a Weber's syndrome, which therefore is ambiguous, being due to a lesion in the brainstem or one in the interpeduncular region.

(4) Basal type: After leaving the brainstem, the third nerve passes forward in the subarachnoid space at the base of the brain, first mesial, then below the peduncle, and then between the posterior cerebral artery and the superior cerebellar artery for a total of 2 cm. before perforating the arachnoid and dura to enter the extradural space. In its "basal" portion the nerve may be damaged by basal meningitis, a tumor, or especially an aneurysm of one of the aforementioned arteries. This type of oculomotor palsy may be monosymptomatic and its topical diagnosis very difficult. A Wassermann test and arteriography, which is not harmless, may aid localization.

(5) and (6) Posterior and anterior cavernous-sinus types: From the point of penetration of the dura until it reaches the superior orbital fissure, the nerve runs within the wall of the cavernous sinus. In addition to the oculomotor palsy, there may be signs of a lesion of the cavernous sinus and involvement of the neighboring fourth, fifth, and sixth nerves. The first and second branches of the trigeminal may be involved only in the posterior cavernous-sinus type of lesion, whereas in the more anterior lesions only the first branch of the fifth nerve is implicated; while a thrombosis of the cavernous sinus and an arteriovenous aneurysm of the carotid artery without venous communication may be symptomless except for the palsy and therefore resemble the basal type of lesion.

(7) Orbital-fissure type: Here the third, fourth, fifth, and sixth nerves are involved, but there are no signs of a cavernous-sinus lesion.

(8) Orbital apex type: A lesion in the apex of the orbit presents signs of third-, fourth-, fifth-, and sixth-nerve disease and also optic-nerve involvement, with central scotoma progressing to blindness, temporal pallor becoming optic atrophy, and, if the lesion takes space, exophthalmos is also present.

(9) Muscular type: The previously mentioned types of third-nerve palsy must be differentiated from lesions in the muscles themselves, as occurring in the nerve endings in myasthenia gravis, or with orbital tumors. In the muscular type of lesions either all or part of the extraocular muscles are involved, and in the latter case the muscles are involved independently of their innervation. For example, a tumor above the eye may involve the superior rectus and oblique muscles, which are innervated by different nerves.

(10) Neuritis type: Neuritis, or other processes restricted to the nerve itself; as in diabetes, infections, intoxications, may produce monosymptomatic oculomotor palsy which may be confused with the basal type.

Discussion. Dr. Percy Fridenberg pointed out that a very early symptom of fifth-nerve involvement in orbital-apex and fissure lesions is silent and must be elicited. This is anesthesia of the frontal branch, missed by most ophthalmologists, but later becoming a severe neuralgia.

Dr. Kestenbaum stated that the diagnosis of anesthesia of the trigeminus cannot be based upon the loss of the corneal reflex alone, but all regions supplied by the nerve must be tested. X-ray studies are of great importance in topical diagnosis but were not discussed. It should be emphasized that the final diagnosis is made by the neurologist; that the ophthalmologist can only interpret the ocular sign to further his purpose.

Leon H. Ehrlich,
Secretary.

MEMPHIS SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

January 8, 1945

DR. T. F. LEATHERWOOD, *presiding*

SYMPATHETIC OPHTHALMITIS FOLLOWING IRIDENCELEISIS

DR. RALPH O. RYCHENER reported a case of sympathetic ophthalmitis with loss of vision in both eyes following iridencleisis for simple glaucoma. Mrs. I. H., aged 64 years, was seen on June 4, 1943, for a routine eye examination. She had no complaints other than an occasional blurring of vision in the right eye and burning and itching of both eyes. The vision was R.E. 6/7.5, improved to 6/6 with $- .50D.$ sph.; L.E. 6/20, improved to 6/6 partly with $+1.00D.$ sph. $\approx +.25D.$ cyl. ax. 90° . The addition of a $+2.50D.$ sph. enabled her to read Jaeger 1 with each eye.

Ophthalmoscopic examination disclosed some lens haze and glaucomatous cupping of the disc of the right eye. Lens haze was present in the left eye and the disc was normal. The tension was R.E. 37 mm., L.E. 25 mm. Hg (Schiotz). There was slight concentric contraction of the visual field of the right eye. The patient was given 1-percent solution of pilocarpine for use in the right eye four times daily and was seen rather frequently until October 26, 1943, during which time the right eye became more myopic, visual acuity decreased to 6/7.5, partly, with correction, and the tension could not be controlled by other miotics. Operation was advised, and on November 1, 1943, iridencleisis was performed on the right eye. There were no surgical difficulties of any kind, convalescence was uneventful, and the tension remained below 20 mm. until December 6th, when she

returned with the left eye red and painful, and the vision diminished to 6/24. Plastic iritis was present in both eyes, and, although posterior synechiae were present, the iris responded well to the instillation of epinephrine-bitartrate crystals.

The patient was hospitalized and given foreign proteins and aspirin in large amounts and made some progress. During this time she developed atropine dermatitis and obtained general toxic symptoms from scopolamine ointment, 0.5-percent.

On January 4th new vessels had appeared on the iris of the right eye so as to give the impression of rubeosis. Two infected, unerupted milk teeth were removed, further foreign-protein therapy was administered, plus pilocarpine sweats and glucose intravenously for cyclic vomiting, but the inflammatory changes progressed until hyalitis, uveal cataract, and angular synechiae with diminution of vision to light perception presented the final picture of the end result of sympathetic ophthalmitis.

Enucleation of the right eye was performed on April 6, 1944, because of intractable pain. Following is the report of the microscopic examination by Col. J. E. Ash of the Army Medical Museum:

Microscopic: There is a scar of a perforating wound of the cornea at the limbus. There appears to be a coloboma of the iris on this side but the rest of the iris and the ciliary body are greatly thickened by a massive granulomatous inflammatory process which also involves the scar and adjacent conjunctiva. Areas of necrosis in the conjunctiva, which appear to have reached the point of caseation, are surrounded by radiating epithelioid cells. There is pigment in and around these tuberclelike lesions and around one of them are giant cells which contain refractile foreign bodies. There is no evidence of caseation in the intra-

ocular granulomas in which the epithelioid and giant cells frequently contain pigment granules. There is diffuse lymphocytic and plasma-cell infiltration of the entire uveal tract. In the choroid this is particularly dense in the outer layers, whereas in the ciliary body it is the inner layers which are particularly involved. The retina shows lymphocytic periphlebitis but is comparatively uninvolved. There are inflammatory pupillary and cyclitic membranes. Serofibrinous exudate occupies the anterior chamber and there is serous exudate in the ciliary body, choroid, sub-retinal space, and vitreous chamber. The retina is detached. The lens has undergone degenerative changes. Because of the uveal distribution of the granulomatous process, intraocularly, we believe this is a case of sympathetic ophthalmia in spite of the caseation and foreign-body reaction in the conjunctiva. We should, however, like to know the condition of this eye before iridencleisis and the present condition of the other eye."

SYMPATHETIC OPHTHALMITIS

DR. RALPH O. RYCHENER reported a case of sympathetic ophthalmitis following an injury to the right eye and resultant involvement of the left eye after 44 days. M. C., aged 27 years, struck in the right eye by a broken log chain on December 2, 1944, was attended by Dr. Stanford Herron, who removed the prolapsed iris and ciliary body and sutured the laceration of the sclera. Vision in the left eye remained 6/6 until the forty-fourth day following the injury, when the left eye began to be painful and the vision failed very suddenly.

The patient was seen in consultation on the forty-ninth day, when the visual acuity in the injured eye was 3/60 and in the sympathizing eye 1/60. Since it was possible that the injured eye might prove

ultimately to be the better eye, enucleation was delayed while active treatment with foreign protein in the form of diphtheria antitoxin, autohemotherapy, and local treatment was instituted. Recurrent anterior-chamber hemorrhages occurred in the right eye, and nine days later this eye was removed.

Pathologic examination disclosed incarceration of the ciliary processes and pigment in the scar of the penetrating wound at the limbus; the lymphocytic infiltration and foci of epithelioid cells indicative of sympathetic ophthalmia were present.

Despite saturation with sodium salicylate, extraction of infected teeth, and all other recommended forms of treatment, the left eye deteriorated to the plastic uveitis which is the end stage of sympathetic ophthalmia. The vision was perception of moving objects only, and the tension was 40 mm. Hg. (Schiøtz):

CYCLODIATHERMY

DR. RALPH O. RYCHENER reported a case of compensated glaucoma in a colored man treated with cyclodiathermy after previous iridectomy. W. A. W., aged 28 years, was seen September 29, 1943, with normal vision in each eye. The tension in the right eye was normal; in the left eye it varied from 48 to 56 mm. Hg (Schiøtz), with a typical glaucomatous field. The tension in the right eye was never recorded as greater than 30 mm. Hg, and the visual field in this eye was normal.

On January 28, 1944, following a congestive attack in the right eye which yielded to paracentesis, a broad-based iridectomy was performed. Despite miotics, the tension steadily rose to 48 mm., and on February 26th a cyclodiathermy with both the Weve tip and micropin was performed across the lower quadrant.

There was marked reaction, the eye became very soft, with much choroidal edema and hemorrhage into both the choroid and retina over the treated area. Visual acuity was reduced to perception of moving objects. Under the administration of atropine and "mixed treatment" internally, there was gradual recovery, and on January 8, 1945, the visual acuity was 20/25, tension was 13 mm., and the fundus was entirely free of hemorrhage and showed only a few chorioretinal scars over the affected area. It was apparent that in this case a lesser application of diathermy current would have produced a good result, since it is undesirable in such cases to induce an iridocyclitis of this degree.

KERATITIS SICCA

DR. RALPH O. RYCHENER reported on Mrs. W. W. B., aged 65 years, who was afflicted with arthritis deformans and complained of ocular discomfort and of burning and itching associated with aropy conjunctival discharge for which she had received much local treatment without relief.

She was seen for the first time on September 11, 1942, at which time there was a diffuse staining of the cornea, with much epithelial debris adhering to the cornea. The Schirmer test showed a wetting of the filter paper of $2\frac{1}{2}$ mm. after five minutes. Locke's solution and holocaine ointment were prescribed, and the Beetham operation advised. This surgical advice was disregarded until June 4, 1943, when all four puncta were sealed off with an actual cautery, and Feldman's solution was prescribed.

There was instant relief of all symptoms and the patient's only complaint after a year was that her eyes were now too moist. It might seem advisable to perform further operations for this condition in two stages, sealing off the lower

puncta first and repeating the procedure above if it seems necessary.

GLAUCOMA

DR. E. C. ELLETT reported a series of cases of glaucoma.

Case 1. Miss M. was seen in 1916, with chronic simple glaucoma. The vision was normal. The discs showed cupping and the visual fields were contracted. The vision failed some in that year and a Lagrange operation was performed on the left eye in November, 1916, and on the right eye in October, 1920. In December, 1944, 28 and 24 years after the operations, respectively, for left and right eyes, the tension was R.E. 19, L.E. 23 mm. Hg (Schiøtz). The visual fields showed some contraction but had remained stationary from 1934 to 1944. Cataracts developed and the lens was removed from the right eye in December, 1944, a combined intracapsular operation being done. The patient was feeble and senile, but the eye had done well.

Case 2. Mrs. J., aged 45 years, had been under observation since she was 9 years old. She wore the following correction: R.E. +5.50D. sph.; L.E. +4.50D. sph., with satisfactory results. In 1921 she had had an acute choroiditis in the right eye which healed with a pigmented scar above the macula. The vision was reduced to 20/40. In 1935 she had an attack of acute glaucoma in the right eye, for which a trephining with complete iridectomy was done. The tension remained very slightly elevated in the right eye. The vision was normal for distance, but defective for near, with an almost complete ring scotoma which included the blind spot. In November, 1944, vision with glasses was R.E. 6/7.5, partly; L.E. 6/6. There was cupping of the disc in the right eye. The left was normal. The tension was 35 mm. Hg (Schiøtz)

in each eye. Eserine did not control the tension, so mecholyl and prostigmine were used. The tension fell to 25 mm. in the right eye, but rose to 60 mm. in the left eye, with pain and some blurring of vision. The tension was relieved by pilocarpine, heat, and morphine, and in two days was 19 mm. The patient was advised to continue using pilocarpine.

Cases 3 and 4. J. R. and S. R., identical twins, aged 48 years, had been under observation for chronic glaucoma for several years.

J. R. was seen in 1916 for a soft movable tumor of the conjunctiva of the right eye. This was removed and reported as a hemangioma. The eyes were otherwise normal. In 1940 a diagnosis of glaucoma was made, and he was given treatment by a doctor in Texas. In 1942 the tension was R.E. 26, L.E. 22 mm. Hg (Schiotz). In 1944 the vision was still normal, with correction for myopic astigmatism. The fundus was normal in each eye. The tension was 32 and 28 mm. The visual fields were normal.

S. R. was seen for the first time in 1931. He also had myopic astigmatism. He had had Buerger's disease for three years, but the eyes were normal. When seen in 1940 the right eye was normal. The left eye showed some lens opacities, a cupped disc, and the tension was 52 mm. In 1944 the left eye showed no change, but the tension of the right eye was 41 mm. The vision was normal in the right eye. In the left eye the cataract had matured, and the vision was reduced to light perception. Since there was a history of trauma to the left eye in childhood it was considered possible that there was a connection between this and the present condition, although in 1931 the vision had been normal, but there were some peripheral lens opacities. Operation was advised on the right eye.

Case 5. Mr. A. H., aged 60 years, was seen for the first time in 1937, when a diagnosis of glaucoma was made. The left eye had been weak as the result of a railroad accident in which he had suffered the loss of an arm and acquired the morphine habit. The corrected vision was 6/7.5 and 6/9. The fundi were normal. The tension was R.E. 24 mm., L.E. 19 mm. Hg (Schiotz). Visual fields were normal. The condition remained about the same until March, 1944, when he had an acute attack of glaucoma in the right eye, with the tension 54 mm. Both irides were slightly atrophic. He would not permit a paracentesis to be performed. In October the right eye was operated on in another city. When seen in December he had a blind and painful eye, but it was impossible to tell what had been done. The left eye was quiet. The tension was 46 mm. There were many small keratitic precipitates on Descemet's membrane. The right eye was enucleated. Treatment with miotics, all of them except doryl, had not reduced the tension in the left eye, which remained around 50 mm. The eye was not painful, the fundus was normal, and vision was 6/12. The visual fields were almost normal. Repeated paracenteses gave only temporary reduction of tension. The iris showed some atrophy and visible vessels. The cornea had cleared somewhat, but was not free of precipitates. On January 6th, a cyclodiathermy with paracentesis was done. The lower half of the eye was treated with contact diathermy and current of 35, exactly as described by Drs. Albaugh and Dunphy. The tension on January 8th was 25 mm.

KERATOCONJUNCTIVITIS SICCA

DR. J. WESLEY MCKINNEY reported the case of Mrs. C. F., aged 39 years, who was seen on June 10, 1942. She complained of redness, burning, discharge,

and photophobia of several years' duration. For the preceding three months the vision had become so blurred at times that she could not read the newspaper. A complete physical examination revealed only a slightly lowered basal metabolic rate and a low-grade anemia. She had received many local treatments of silver nitrate and had taken vitamins, iron, and thyroid for an extended period of time. Examination revealed that the palpebral conjunctiva was red and thickened and had a ropy secretion. There was slight circumcorneal injection and epithelial keratitis with many filaments. The eyes were internally normal and the tension was normal. The vision was R.E. 20/50, L.E. 20/30, with correction. Schirmer test revealed the litmus paper to be wet only 3 mm. in 5 minutes. She was given Locke's solution which improved her condition partially, but she was still so uncomfortable that she readily accepted the suggestion for obliteration of the puncta. Consequently, all four puncta were obliterated by means of the diathermy needle. Relief was almost immediate. The conjunctiva and cornea rapidly returned to normal, the vision to 20/20 in each eye. She was able to read with comfort for the first time in several years.

CHRONIC BLEPHAROCONJUNCTIVITIS DUE TO LID WARTS

DR. J. WESLEY MCKINNEY reported the case of Mr. A. M. E., aged 57 years, who was seen for the first time on October 12, 1942. He had received much local treatment for chronic blepharoconjunctivitis of the right eye, all the local medications having been applied without benefit until two small marginal lid warts were removed from the upper lid. Following the removal of the warts, the blepharoconjunctivitis cleared rapidly and there had been no return of the

condition. It is supposed that this conjunctivitis resulted from the virus infection associated with the warts.

UVEITIS WITH ALOPECIA, POLIOSIS, VITILIGO, AND DYSACOUSIA—REPORT OF TWO CASES

DR. G. K. KAMBARA, by invitation, said that Vogt first described the syndrome wherein uveitis was associated with alopecia, vitiligo, poliosis, and dysacusia in 1906. Later a larger series was reported by Koyanagi and Harada from Japan. Depigmentation of the lashes had been reported associated with iritis as far back as 1873 by Schenkl and in 1874 by Jacobi. Association with vitiligo was reported by Gilbert in 1910.

This disease occurs most frequently in the third decade of life. The uveitis is usually bilateral and of an exudative type. It is slowly progressive. The process seems to be self-limiting with good vision maintained in about 30 percent of the cases; however, more frequently, there is permanent loss of vision. The fundus picture is one of edematous retinitis and choroiditis.

The alopecia and the poliosis of hair, eyebrows, and lashes occur in 90 percent of the cases. Vitiligo and dysacusia occur in 50 percent. Occasionally there are signs of meningeal irritation.

Nothing definite is known as to the etiology. An endocrine origin was postulated by Koyanagi, but Duke-Elder thinks more of the toxic origin. Treatment is symptomatic. Any operative procedure is usually unsuccessful.

The two patients whose cases are reported below did not show dysacusia. Both did complain of arthritis, however.

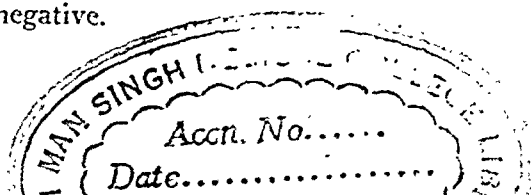
Case 1. A colored woman, aged 36 years, was seen for the first time in the Eye Clinic of the Memphis E.E.N.T. Hospital on May 23, 1943. She com-

plained of a painful left eye since having a tooth extracted in September, 1942. The vision was R.E. 20/20-2, L.E. 20/65. Examination revealed keratitic precipitates and posterior synechiae. A diagnosis of acute iritis was made, and heat and atropine were prescribed. Two milk injections were given, with some improvement of the patient. One month later papillitis was noted in the left eye. Kline test was negative. On August 18, 1943, a tonsillectomy was performed because of recurring sore throats and earache of several weeks' duration. From July to November the patient did not return to the Eye Clinic. When she did return she had seclusion and occlusion of both pupils but no iris bombé. There were still ciliary injection and many keratitic precipitates. Tuberculin tests of 1:10 and 1:100 dilution were negative. She complained of pain in her knees. Another general medical examination was advised. In December, 1943, tuberculin treatment was started with 1 mm. of 1:100,000 tuberculin. A course of typhoid antigen starting with 10 million organisms was also given for five doses. No appreciable improvement was noted. An iridectomy was performed with difficulty on January 28, 1944. The iris was very adherent and atrophic. In one month's time the iridectomy area was covered again. Tuberculin treatment was again instituted, starting this time with 1:2,000 dilution. In April, a course of X-ray treatments was given to both eyes at the John Gaston Hospital. Following this the eyes were more painful. In May there were numerous nodules on the iris and hypopyon was also present. By July, 1944, more and more new vessels were appearing on the iris, hypopyon was still present, and the patient showed local reaction to the tuberculin. The tuberculin was discontinued.

In August, 1944, she had the remaining

teeth extracted and felt improved. When she returned in October she showed depigmentation around the lids. The lashes had turned gray. She had developed alopecia and poliosis in the hair of the parietal region. The cornea of the right eye had turned opaque. Her condition was shown on slides.

Case 2. A Japanese woman, aged 46 years, was seen in the Tule Lake WRA Hospital in September with a complaint of painful eyes for several months. Examination at that time revealed ciliary injection, keratitic precipitates, and areas of posterior synechiae. Attempts at dilatation of the pupil with adrenalin and atropine were not very successful. She was given a course of typhoid-"H"-antigen foreign-protein therapy with only slight improvement. While in the Hospital she complained of headaches, and joint pains as well as ocular pains. All her teeth were extracted. With each extraction she suffered a flare-up in her eyes. Sulfadiazine by mouth was given for about two days, without appreciable effect. The synechiae increased until she had total seclusion and occlusion. Several weeks after the typhoid treatments, her hair started to fall out in spots and the remaining hair became gray and coarse. She was seen by an ophthalmologist from Stanford University and Klamath Falls on different occasions. A second course of typhoid was given about two months later. A few months later vitiligo was noted around the neck and face. Then still later her lashes started to turn white. During the time under observation from September, 1942, until June, 1943, her eyes became progressively worse. She had pain and ciliary injection when last seen. She had no hearing impairment. Wassermann and tuberculin tests were negative.



AMERICAN JOURNAL OF OPHTHALMOLOGY

Published Monthly by the Ophthalmic Publishing Company

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Author's proofs should be corrected and returned within forty-eight hours to the *Manuscript Editor, Miss Emma S. Buss, 121 Woodbine Avenue, Wilmette, Illinois*. Twenty-five reprints of each article will be supplied to the author without charge. Additional reprints may be obtained from the printer, the George Banta Publishing Company, 450-458 Ahnaip Street, Menasha, Wisconsin, if ordered at the time proofs are returned. But reprints to contain colored plates must be ordered when the article is accepted.

DR. HAESSLER EDITS THE ABSTRACT DEPARTMENT

The Abstract Department of the American Journal of Ophthalmology has occupied a distinctive position in the journalism of the specialty. The Germans were pioneers in the attempt to present to their readers a comprehensive summary of the periodical literature of ophthalmology. Other abstract departments than that of Theodore Axenfeld in the *Klinische Monatsblätter für Augenheilkunde* and that presented by the American Journal of Ophthalmology for the past nineteen years have usually made very

little pretense at completeness, and most of them have represented simply a sort of space "filler."

More systematic annual review of the periodical literature of ophthalmology was attempted in the German *Jahresbericht*, whose date of publication was, however, usually a year or two behind the original dates of publication of the material which it surveyed.

Edward Jackson undertook, at first inadequately, later more comprehensively, to gather the world's ophthalmic literature in a single publication, the *Ophthalmic Year Book*, appearing soon after pub-

lication of the original material. When, in 1926, on account of financial and other difficulties encountered, Jackson decided that it was necessary to discontinue the Ophthalmic Year Book, the present writer proposed an attempt to furnish a fairly sufficient substitute for the Year Book in the form of an abstract department which should at least approach completeness of presentation of the world's current ophthalmic literature.

There can hardly be any question that such a department is of value to the general reader, and of much greater value to those who have occasion to carry on literary research; although it must be acknowledged that many subscribers to medical periodicals find little time for thorough reading.

Successive labors on the Ophthalmic Year Book, on the general editorship of the Journal, and in the conduct of the Abstract Department have occupied a substantial share of the present writer's time for the past thirty-five years. Such tasks bring many rewards in the sense of service to the profession, in contact with the best of the world's medical literature, and in delightful and stimulating personal associations. But it does not seem unreasonable to seek leisure in the evening time of life. The writer, therefore, with mingled regret and satisfaction, yields the editorship of the Abstract Department to other hands. Beginning with the current issue, the Department will be edited by Dr. F. Herbert Haessler, who was a collaborator on the Ophthalmic Year Book and who for many years has furnished some of the best material of the Abstract Department. The present writer, who greatly values Dr. Haessler's willingness to devote himself to this task, wishes him success, and at the same time cordially thanks the many willing helpers who by their labors have made the Abstract

Department possible.

(The writer feels that this message to our readers would not be complete without sincere acknowledgment of the earnest and capable service rendered in this work for many years by his secretary, Miss Grace M. Carter.)

W. H. Crisp.

AMERICAN OPHTHALMOLOGICAL SOCIETY MEETING

The eighty-first annual meeting of the American Ophthalmological Society was held on November 12th, 13th, 14th at the Homestead, Hot Springs, Virginia. This is an unusual time of year for this meeting which is regularly held at the end of May or the first part of June each year. It had, however, been voted to omit the 1945 gathering because of the war. With the cessation of hostilities the Council decided to hold a belated meeting because of papers previously prepared and in order not to interrupt annual meetings which had been held every year for 80 years.

There was question in the minds of the officers as to the likelihood of good attendance, owing to the relatively unfavorable time of year and the difficulties of transportation. Much to their surprise, however, the gathering was the largest this Society has ever held. The weather, too, smiled on the meeting and the first two days were warm and sunshiny. The third day, however, was raining and ended in light snow.

First, of course, should be mentioned the scientific program, not only because, however pleasant the social aspects, the primary purpose of this Society is now and always has been scientific. From its meetings have emanated many outstanding contributions to ophthalmology. This meeting was no exception. In fact, many of the

members and guests stated that it was one of the best programs that they had ever heard. Space will not permit more than mention of a few of the subjects discussed. But a word might be said about some especially interesting items.

No one could ask for a clearer exposition of some physiologic factors in the differential diagnosis in the superior rectus and superior oblique paralyses than that given by Adler. The illustrations and diagrams were almost sufficient without the clear discussion by the author. Bedell showed beautiful colored photographs of retinal proliferation in diabetes. The listener can always count on seeing the most beautiful examples of fundus photography whenever Dr. Bedell presents a paper of which the subject can be so illustrated. Ruedemann showed examples from a series of over 100 plastic eye implants in all types of sockets. The prosthesis is placed inside of the muscle cone and the recti muscles are attached to it through appropriately placed holes in the material. Undue reaction does not follow the operation and obviously splendid motion is obtained. Surprisingly the conjunctiva takes care of itself satisfactorily without suturing to the acrylic implant. The technique is difficult and probably improvements will be found. But the procedure seems worthy of careful study. Samuels presented beautiful slides of pathologic eyes illustrating cataract and intraocular tumors. His specimens were, as usual, always of the highest order.

Beautiful illustrations of keratoplasty were shown by Castroviejo, and a catalogue of suitable types for this procedure and those better suited to keratectomy were outlined. This classification should be useful to those whose experience is limited.

Gundersen, one of the few members still in service, presented evidence from

19 Vossius rings that the iris margin has nothing to do with their formation, their size being practically the same irrespective of the hour of day or night that the injury took place. He thought also that the deposit could scarcely be due to attached iris pigment and likened it further to the central disc seen in capsular exfoliation and somewhat similar to arrangements of deposits in the anterior capsule in chronic intraocular inflammation. In general, his conclusion was that some fundamental characteristics of the lens capsule were probably responsible for the formation of the ring.

Kirby made some important points regarding ptosis and pseudoptosis. His talk indicated the necessity of careful differentiation between the two as a preliminary to possible surgery and a knowledge of whether the superior rectus was truly paralyzed or not.

Berens showed interesting statistics on the relative value of nylon; plain and chromic catgut, and silk, especially as concerned the coefficient of friction, post-operative reaction, and rate of absorption.

The meeting introduced two departures from custom, though not entirely unique features; namely, a reception for new members on the second day of the meeting followed by a banquet in honor of Dr. Vail, recently Colonel in the Medical Corps of the U. S. Army, Senior Consultant in Ophthalmology in the European theater, and Chief Consultant in Ophthalmology to the Surgeon General. The dinner was also in honor of Prof. Ida Mann of the Eye Hospital, Oxford, England, who has been visiting this country to study the eye institutions with a view to incorporating useful ideas into the construction of new eye hospital at Oxford and rebuilding the badly damaged structure at Moorfields. The presence of

Professor Mann with her equally delightful husband, Professor Gye, and her description of some phases of English ophthalmology at the dinner added much to the pleasure of the meeting. Dr. Vail gave a very interesting talk on his war experiences in ophthalmology. Among the most enjoyable features of the banquet were the delightful remarks of Dr. Beech, the President of the Society. His keen humor did much to enliven the evening.

Dr. Eugene M. Blake was elected president for the ensuing year and Dr. John W. Burke vice-president. Dr. John A. MacMillan was appointed the new council member and The Homestead chosen for the spring meeting unless the American Medical Association meets in the West, in which case plans may be changed to avoid unnecessary travel for those who desire to attend both meetings.

Lawrence T. Post.

THE NEED FOR MORE BASIC COURSES IN OPHTHALMOLOGY

The reestablishment of the basic course in ophthalmology at Northwestern University Medical School serves to call to our attention the crying need for the establishment of more similar courses as a precursor of residencies in ophthalmology. At the present time there are only three other courses of this type available: the one at the University of Pennsylvania, which is the oldest, one at Washington University in Saint Louis, and the one given by New York University.

The war has shown the need for more well-trained ophthalmologists in this country. From the number of applications received from returning veterans who are desirous of obtaining an adequate training in ophthalmology it is obvious that the needs can be filled if the training facilities are made available. At the pres-

ent time the opportunities are quite inadequate.

A three- or four-year residency in a well-established division of ophthalmology in one of the large university medical schools is probably the ideal way of obtaining a training in ophthalmology. Here, as part of the training, the basic sciences are taught by lecture and laboratory work. Here also are opportunities for work in the anatomy, special pathology, bacteriology, and research laboratories. The unusual library facilities also encourage study of the rare and most recently reported conditions. The association with the teachers of other branches of medicine tends to broaden the outlook and increase the knowledge of the relationship of other branches of medicine and ophthalmology. These opportunities are limited, as the number of residencies of this type is small. From this group must come our teachers, our research men, pathologists, and consultants. It is from this group that the teachers of the basic courses of shorter duration must also be obtained.

As already stated, the number of these regular residencies is entirely inadequate and not sufficient to fill the needs of the specialty. There are, however, many hospitals, especially larger county hospitals away from medical-school centers, that have competent clinical ophthalmologists who could and do teach clinical ophthalmology well. These men often have neither the time, inclination, background, nor the facilities properly to teach the basic sciences. For residents in such appointments the basic-science course as given by the four above-mentioned institutions is not only advisable but essential in the development of a "safe ophthalmologist." In these courses, of from 6 to 8 months' duration, the time is devoted to lectures, laboratory, and

clinical demonstrations. Thus in a relatively short time the foundation is laid for the future development of a dependable ophthalmologist. From personal observation it is apparent that the men who have followed up such a course with a year or two in some institution or clinic have done very well. It should be pointed out that this year of basic training must be followed by carefully supervised clinical work.

Unfortunately, because of the facilities required for such courses, the number of places available in these four established courses is limited and not sufficient to fill the needs. From the foregoing it is apparent that other facilities must be provided to make available to more men the proper teaching in the basic sciences of ophthalmology, which while not ideal would train them sufficiently well to qualify them for their American Board of Ophthalmology examinations; in other words, qualify them to be "safe ophthalmologists."

While less ideal than these methods of training the one suggested by Gradle warrants serious consideration. Gradle's suggestion is that a three-months' concentrated course in the basic sciences be given in a number of centers immediately following the general-interne year, and that the residencies start in October; that is, after the three-months' course. It would probably be advisable for a committee, perhaps representing the three major eye societies, to work out a uniform course of instruction that would cover the essential subjects and outline the methods of teaching to be used. This would permit the resident to devote three months to concentrated study without the care and responsibilities of a clinic, a great help if the resident had an appointment in an institution where one resident must shoulder the entire responsibility. In ad-

dition, the basic course would give him sufficient foundation to be of some help to the institution from the start. It would also have the tendency to encourage more institutions to resume the responsibility for the clinical training of men.

Training can also be obtained through preceptorship and association in private practice with a well-qualified and well-trained ophthalmologist. Here, especially, it is essential that the individual obtain his basic course before starting in practice, as the pressure of private practice is not conducive to theoretical instruction from the preceptor. However, having had the basic course and following it up with carefully planned reading, such as the Home Study Course of the American Academy of Ophthalmology and Otolaryngology, the young ophthalmologist is assured proper guidance in training.

It is hoped that American ophthalmologists, both teachers and clinicians, realize their responsibility and duty in the training of ophthalmologists and that more institutions establish basic courses as a precursor of residencies in ophthalmology.

Frederick C. Cordes.

BOOK NOTICE

ÉLÉMENTS DE GONIOSCOPIE NORMALE, PATHOLOGIQUE ET EXPÉRIMENTALE. By Archimede Busacca. Stiff paper covers, 200 pages, 81 illustrations including four plates, one in color. São Paulo, Brazil, Tipografia Rossolillo, 1945. Price not stated.

This book is an excellent statement of the author's personal study of the subject and of his conclusions; as well as a discussion of his own views and those of other writers with regard to many points in anatomy and diagnosis with regard to which differences of opinion exist. The

author suggests that, in the region dealt with, small differences of relief are of great importance, so that the region can be studied efficiently only by means of stereoscopic vision, the best conditions for examination being afforded when one applies to the study of the iridocorneal angle biomicroscopy as it is currently practiced for other parts of the eye. So keen were Salzmann's powers of observation, that Busacca believes other ophthalmologists, although provided with more perfect apparatus, have added little to Salzmann's observations as published in 1915, those observations having been made with the ophthalmoscope. The most satisfactory recent device for study of the chamber angle is that of Goldmann (*American Journal of Ophthalmology*, 1939, volume 32, page 444), who devised a contact glass furnished with a mirror in which the image of the angle is reflected.

A preliminary chapter on the technique of examination, using the Goldmann appliance, is followed by a chapter of general anatomic data on the chamber angle, and exhaustive chapters on the normal and pathologic angle.

In the chapter dealing with the pathologic angle, details dealt with include modifications of the angle following inflammatory processes of the uvea; gonioscopic aspects after operative interventions (iridectomy, cyclodialysis, incarceration of the iris); gonioscopy in diseases of the cornea; gonioscopic modifications in dislocation of the lens, in congenital deformities of the iris, and in glaucoma of various types. A note is added on the

zonule and the ciliary processes in gonioscopy.

A final chapter describes chiefly the author's personal experiments as to the modifications produced by atropine and eserine in the region of the chamber angle, particularly as regards the behavior of the ciliary body in iridectomized eyes. (Bibliography, 88 case records, index.)

W. H. Crisp.

CORRESPONDENCE

CONTINENTAL OPHTHALMOLOGISTS NEED OPHTHALMIC LITERATURE

Editor,

American Journal of Ophthalmology:

Since 1941, American publications have not been available to most of the Continental centers and investigators. I have had several letters from ophthalmologists abroad indicating the desire and need for ophthalmic literature which has appeared during these war years.

It occurred to me that some subscribers of the *American Journal of Ophthalmology* with copies for the past several years would be willing to send their copies abroad to ophthalmic centers or individuals. If such subscribers would write to the Howe Library of Ophthalmology, c/o Miss Jeanette Loessel, 243 Charles Street, Boston 14, Massachusetts, a name and address will be provided to which the *American Journal* may be sent. Arrangements are being made to reimburse the donors for the cost of mailing.

David G. Cogan, M.D.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

- | | |
|--|--|
| 1. General methods of diagnosis | 10. Retina and vitreous |
| 2. Therapeutics and operations | 11. Optic nerve and toxic amblyopias |
| 3. Physiologic optics, refraction, and color vision | 12. Visual tracts and centers |
| 4. Ocular movements | 13. Eyeball and orbit |
| 5. Conjunctiva | 14. Eyelids and lacrimal apparatus |
| 6. Cornea and sclera | 15. Tumors |
| 7. Uveal tract, sympathetic disease, and aqueous humor | 16. Injuries |
| 8. Glaucoma and ocular tension | 17. Systemic diseases and parasites |
| 9. Crystalline lens | 18. Hygiene, sociology, education, and history |
| | 19. Anatomy, embryology, and comparative ophthalmology |

5

CONJUNCTIVA

Kadlicky, Roman. The chemotherapy of pyogenous conjunctivitis. *Klin. M. f. Augenh.*, 1941, v. 107, Aug., pp. 136-137.

Use of a sulfonamide (Dipron, which is 4 Aminobenzensulfonamide) by mouth has not only simplified the treatment of gonorrheal conjunctivitis of the new-born and adults, but is far superior to any previous method of treatment. F. Herbert Haessler.

Lewis, G. G. Ophthalmia neonatorum. *Med. Record*, 1945, v. 158, June, p. 351.

The author stresses the importance of ophthalmia-neonatorum blindness. In institutions 30 per cent of the blind had this condition. The organism involved may be gonococcus, pneumococcus, Koch-Weeks bacillus, staphylococcus aureus, bacillus coli, or other organism. The disease can invariably be prevented if proper prophylaxis is observed, and readily cured if early and proper treatment is instituted. Any per-

son engaged in midwifery should be strictly accountable for the proper care of the baby's eyes after delivery. The author gives his method of treatment, including frequent irrigation, silver-nitrate solution and, absolute cleanliness. Robert N. Shaffer.

Melik-Musian, B. N. The intravenous, subconjunctival, intramuscular, and subcutaneous use of sulfidine in trachoma. *Viestnik Oft.*, 1944, v. 23, pt. 6, p. 29.

On the basis of treatment of three hundred cases, intravenous administration has proved the most effective. Subconjunctival use proved too irritating and had to be abandoned. Intramuscular or subcutaneous administration works much more slowly, and is only used when intravenous administration is not practicable. Half-percent solutions, administered twice daily at an interval of 4 to 5 hours, 10 c.c. for the adult and 5 c.c. for the child, have been found adequate. In the presence of diplobacilli, zinc sulphate is used in ad-

dition, and follicles when massive are expressed. The results surpass those of all other treatments. A pannus crassus melts away under the method. Only five of the cases returned with relapses. The treatment is given during one month, at most. Usually patients are discharged cured in 20 to 25 days.

M. Davidson.

Volokitenko, A. E. The streptocide treatment of trachoma. *Viestnik Oft.*, 1944, v. 23, pt. 6, p. 32.

Complete cure was achieved in 60 percent of the thirty cases treated and improvement in the rest. Half of them had been in existence more than 2½ years, and all stages were represented. In some cases the effect was not noted immediately. Internal administration of 1 to 1.5 gm. per day was found adequate. Neither larger dosage nor addition of local use of the drug was found of any advantage. Effects were noticeable in less than two weeks.

M. Davidson.

Wolter, Friedrich. The occurrence of epidemic ophthalmia (kerato conjunctivitis nummularis epidemica) in Germany since 1938. *Klin. M. f. Augenh.*, 1941, v. 107, Aug., pp. 113-135.

In this 25-page analysis of epidemics of ophthalmia the author emphasizes the mode of occurrence of epidemics in order to clarify the factors that bring them about. Though he briefly describes the manifestations of the epidemics of eye disease which recently occurred in Germany and which seem to be identical with the shipyard epidemics in America, the theme of his work is the study of the process of epidemic morbidification. The epidemic of ophthalmia which occurred in Egypt in the period from 1798 to 1801 is particularly illuminating. The analysis of

this and other epidemics, the manifestations of which are well recorded, strengthens Wolter in his adherence to a view which he has previously published—namely that the epidemiologic concepts of Pettenkofer on the one hand and of Pasteur and Koch on the other are not irreconcilably antithetic. The older writer derived epidemic diseases from miasmatic, telluric, and meteorologic factors. The gaseous exhalations from the earth necessarily bound the epidemic to a certain area at a certain time. Careful analysis of the records of epidemics seems to confirm this belief. Ophthalmias that went through regiments of soldiers in Italy, for example, immediately ceased when the soldiers were transferred to France. The modern view ascribes the spread of the epidemic disease to the spread of the causative virus or bacterium. Nevertheless the facts that emerge from the study of the records of epidemics cannot be denied and the author emphasizes the importance of the study of the many neglected factors which are necessary to bring about dissemination of the immediate causative agent. Since the advent of the bacteriologic era only the latter has been considered, to the entire neglect of other indispensable factors which in prebacteriologic times were called miasma or contagium. (Bibliography.)

F. Herbert Haessler.

6

CORNEA AND SCLERA

Chernikova, T. V. Sulfazol treatment of corneal ulcers. *Viestnik Oft.*, 1944, v. 23, pt. 6, p. 25.

Good results are reported from use of a 5-percent sulfazol ointment in 80 cases, among them 32 of *ulcus serpens*. Secondary iritis was noted in many and

is attributed to the toxic effect of the drug. M. Davidson.

Czukrász, Ida. **Scleral defects and their treatment.** Klin. M. f. Augenh., 1941, v. 107, Sept., pp. 245-257.

A report of 14 cases of defects of the sclera, operated upon according to the author's previously described procedure, namely covering the defect with combined conjunctival and Tenon's-capsule flaps. Nine cases were traumatic, two tuberculous, and three had developed scleral necrosis after Blascovics' strabismus operation (myectomy). (References.) F. Nelson.

Friede, Reinhard. **Causes, prevention, and treatment of opacities in keratoplastic grafts.** Klin. M. f. Augenh., 1941, v. 107, Nov., pp. 480-506.

The eyes of receiver and donor need careful preparation before transplantation. Tissue vitality has to be increased. The metabolism of the cornea needs improvement. The operation has to be performed with as little damage as possible to corneal tissue. Differences in thickness between the donor's and the receiver's cornea should be avoided. The graft should not be placed in any kind of fluid that could cause swelling of the tissue. If the anterior chamber of the receiver is shallow all remnants of exudate and blood should be removed, since their presence would lead to undesirable membrane formation. Grafts should be secured by cross sutures in every case.

To keep the graft from becoming opaque the author recommends the following rules: Abnormal swelling of the tissue should be treated before operation. Only donor eyes with normal osmotic pressure of the corneal parenchyma should be used. Epithelium and

endothelium should be normal in function. Grafts from eyes suffering from chronic or acute uveitis should not be used if other material is available. The graft, after being placed in the receiver's eye, needs attention and treatment at once, and carried through from two to three weeks. Even if the operated eye shows no irritation, prophylactic treatment of the patient, especially with foreign-protein injections, should start immediately in order to avoid irritation and exudation in the anterior segment of the eye. The author declares most emphatically that local and internal dehydration is of greatest importance to prevent undesired swelling of the corneal tissue and to increase the healing tendency. If shortly after transplantation the graft tends to become cloudy, Friede uses highly hypertonic solutions locally. Highly concentrated dextrose and leucose solutions are useful, but undissolved powdered sugar, put directly on the cornea and in the conjunctival sac, is even more effective. The author reports three cases of total corneal leucoma, operated upon successfully. The grafts became cloudy but cleared up again after general dehydration and local sugar applications. (7 figures.) F. Nelson.

Henderson, J. W., and Gillespie, D. R. **Unusual type of corneal opacities.** Amer. Jour. Ophth., 1945, v. 28, Nov., pp. 1236-1244.

Hofe, K. vom. **Clinical contribution to the understanding of keratitis neuroparalytica.** Klin. M. f. Augenh., 1941, v. 107, Aug., pp. 154-159.

Hofe describes the clinical course of corneal lesions in six patients in whom the Gasserian ganglion had been destroyed by electrocoagulation. Behr has described two forms of corneal dis-

turbance, namely central loss of epithelium in a round central area that heals with a dense scar and more extensive but also more benign punctate epithelial destruction which involves the entire corneal surface or at least its lower portion. In the author's patients both of the lesions occurred in the same eye at different times, and contrary to Behr's experience recurrences were not uncommon. Though the theory of trophoneurotic origin of these lesions has much support the author points out that in three of his patients the lesion followed trauma. In one of them there was evidence of physical trauma to the anesthetic eye, of which the patient was unaware. In the other two a loss of transparency of the epithelium such as is associated with chemical burns followed exposure to cold in one and contact with a drop of dilute alcohol in the other. (1 figure.)

F. Herbert Haessler.

Imre, Josef. **Clinical and histologic experience with corneal grafts.** *Klin. M. f. Augenh.*, 1942, Supplement 14, 50 pp.

To aid colleagues who have little practice in corneal grafting, Imre exhibits his accumulated experience. In the first 16 pages he describes in detail his operative procedure. He uses only grafts of living cornea, obtained by trephining from an eye just enucleated. The disc of clear cornea is inserted into a circular hole in the eye of the host, made by means of a Hippel automatic trephine. A safety collar surrounds the blade 1 mm. above the cutting edge. Only once has the writer injured a lens. The graft is immediately fitted into the opening, and a previously prepared conjunctival flap is sutured over the entire cornea.

In the remaining 34 pages Imre dis-

cusses his results. Of 98 eyes operated upon, the graft remained translucent in 56, and the visual acuity was improved in 42. In 31 cases the operation was performed on eyes such as are usually considered unsuitable for the operation, yet even so the statistics are encouraging. More than 20 eyes are discussed in detail and with colored photographs and some histologic illustrations. The beginner is advised to do his first few transplants on hopelessly defective eyes. (1 table, 64 illustrations, several in color.) F. Herbert Haessler.

Krasnov, M. L. **Albucid treatment of hypopyon keratitis.** *Viestnik Oft.*, 1944, v. 23, pt. 6, p. 22.

A 30-percent aqueous solution or ointment has proved the best means of treatment of hypopyon keratitis. A ten-percent solution was not effective, nor was the stronger solution effective in scrofulous or herpetic ulcer. Frequent instillation is important, intravenous urotropine enhances the effect, and use of atropine locally is necessary. No case required surgical intervention, none went on to perforation, and only fine nebulae remained. M. Davidson.

Miklós, A. **Treatment of serpent ulcer by means of total covering with a conjunctival flap.** *Klin. M. f. Augenh.*, 1941, v. 107, Aug., pp. 138-154.

In the early stages of rather benign forms of serpent ulcer, energetic conservative treatment often brings about healing. In more serious forms none of the usual heroic methods of treatment—steam cauterization, trephine, paracentesis, splitting the base of the ulcer—has given so satisfactory results as conjunctival covering. Partial covering is inadequate, presumably because the adhesion between the entire ulcerated area and the conjunctival tissue de-

velops too slowly. Total covering is easily accomplished and should be preceded by curettement of the ulcer. It can be done in ambulatory patients. The author uses the technique described in the surgical treatise by Blaskovics and Kreiker. When healing is complete the adherent conjunctiva can be dissected from the cornea without difficulty. Results are most satisfactory. (13 illustrations, references.)

F. Herbert Haessler.

Radnót, Magda. The occurrence of corneal epithelium in the interior of the globe after ulcerous destruction in the cornea. *Klin. M. f. Augenh.*, 1941, v. 107, Aug., pp. 147-154.

The author describes histologic preparations from two eyes in which the epithelium had proliferated into the interior. The cause was not accidental or surgical trauma but ulcerative destruction of corneal tissue—a condition which has been rarely noticed before. In one of these eyes keratomalacia with destruction of the cornea was followed by iris prolapse and fistula. The corneal epithelium proliferated on the surface of the granulated tissue. In the other eye an epithelial cyst and an island of epithelial tissue developed within the eye after perforation resulting from gonorrheal inflammation in a new-born infant. The newly formed intraocular masses of epithelial tissue are separated from the cornea and iris by cicatricial tissue. (7 illustrations, references.) F. Herbert Haessler.

Salzer, Fritz. How do corneal defects become regenerated? *Klin. M. f. Augenh.*, 1941, v. 107, Oct., pp. 389-404.

A critical survey of the results of studies in comparative histology and embryology, as well as of tissue cultures, which all point in the same direc-

tion, makes it highly probable that the cornea is epithelial in origin, development, and regeneration. It must still be decided whether new corneal cells can be grown from stromal explants, remembering that differences in behavior of corneal cells may occur when they are stimulated in the explant by culture medium, embryonal juice or other trephone, and that in life they may remain passive because the epithelium does all that is necessary. Certainly there are no reasons for believing that a two-weeks-old mass which fills a corneal defect with cells morphologically and tinctorially indistinguishable from epithelial cells will be replaced later by proliferation of corneal cells. If contrary to expectation this should occur it would only show that in corneal regeneration all embryonic layers function together in an integrally organized process but that the epithelial functions are decisive in the pattern. (7 figures, bibliography.) F. Herbert Haessler.

Sato, Tutomu. Surgical method for keratoconus treatment (splitting of Descemet's membrane.) *Klin. M. f. Augenh.*, 1941, v. 107, Sept., pp. 234-238.

A special very small knife, curved at the end, is introduced into the anterior chamber through the limbus at the three and nine o'clock positions respectively, and Descemet's membrane as well as a good deal of the corneal parenchyma is incised from the rear in the horizontal meridian across the area of highest elevation of the keratoconus. The incision should be 3 to 5 mm. long. In case only a little of the corneal stroma is cut, one or two more cuts may be made parallel to the first one. Should the cornea be perforated during the operation, atropine is used in order to avoid anterior synechia. Otherwise

eserine is instilled. Immediately after the operation the internal corneal wound appears as a spindle-shaped cleft. The next day the vicinity of the wound is cloudy, and the stroma is swollen. Subsequently the thickness of the conical area of the cornea increases, and in the course of two or three months the conical shape disappears more or less, and the curvature approaches normal. Twenty-four eyes were operated upon, mostly with good results as to vision and shape of cornea. In many cases the myopia decreased considerably. (1 table, 6 figures.)

F. Nelson.

Schlichting, Hans. Vesicular endothelial dystrophy of the cornea. *Klin. M. f. Augenh.*, 1941, v. 107, Oct., pp. 425-435.

After a review of the literature on degenerative lesions of the posterior surface of the cornea, the author describes an observation of his own which concerns two cases of bilateral endothelial corneal dystrophy in father and daughter. The lesion involved the central area of the posterior corneal surfaces and consisted of round and oval vesicles and depressions of varying size. It is possible that the depressions were the end result of vesicles which protruded into the anterior chamber and had ruptured. The normal markings seen in specular reflection were partially obscured in the areas between the vesicles. Ophthalmometer readings suggested keratoconus, and certainly the myopia was corneal in origin because, when a contact glass with a curvature equal to that of the normal cornea was applied, retinoscopy revealed one diopter of hypermetropia. The difference between this lesion and similar ones recorded in the literature leads the author to conclude that this is a new

and unique observation. (2 figures, bibliography.) F. Herbert Haessler.

Zwiling, M. D. Scleromalacia perforans. *Viestnik Oft.*, 1944, v. 23, pt. 4, p. 36.

A case is reported accompanied by arthritis and macular degeneration, and located near the limbus, with atrophy of an adjacent iris sector, and cystic degeneration of the 7 by 3 mm. formation.

M. Davidson.

7

UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Bulach, K. O. The problem of early diagnosis of an "exciting" iridocyclitis. *Viestnik Oft.*, 1944, v. 23, pt. 6, p. 7.

The problem of potentially "exciting" uveitis in wartime is important. While 97 to 98 percent of enucleated eyes do not show the specific pathology suspected, the possibility alone justifies enucleation. With the object of verifying the studies of Rabinovich, which indicated the possibility of making an early diagnosis of the specificity of the uveitis by increase of blood monocytes, blood studies were made on 120 persons in whom one eye had been enucleated because of perforating injury. Only three showed specific pathology. The conclusion arrived at is that monocytosis is related to the acuteness and severity of the inflammatory process of the uvea rather than to its specificity.

M. Davidson.

Friedman, S. J. The prophylaxis, diagnosis, and treatment of sympathetic ophthalmia in the light of further observations. *Viestnik Oft.*, 1944, v. 23, pt. 5, p. 37.

Without a clear concept of its

genesis we have been handicapped in prevention and treatment of sympathetic ophthalmia. Until now we have been preoccupied with the mode of transmission from eye to eye and with the nature of the pathogenic agent. There is evidence in favor of a meningitic process mediating between the exciting eye and the sympathizing eye, and of the ocular affection not being limited to the eyes. The meningitic process is of the serous basal type with meager symptomatology, and the sympathetic ophthalmia responds to the same treatment to which basal meningitis responds, namely, spinal punctures. These therefore are indicated in all uveitides, and in the prevention of sympathetic ophthalmia. Two cases additional to those previously observed are reported in detail. Further arguments in favor of the relation between the meningitic process and sympathetic ophthalmia are advanced. The 2 or 3-weeks interval between the appearance of the process in one eye and its appearance in the other is similar to that observed in development of uveitis secondary to a virus in basal meningitis. The development of sympathetic ophthalmia after enucleation, sometimes 2 to 3 months later, and at times years later, argues for localization of the infectious process at the base of the brain. The occasional observation of optic neuritis in sympathetic ophthalmia is also in favor of a chiasmatic arachnoiditis. Both sympathetic ophthalmia and meningitis are more common in children, and the fact of sympathetic ophthalmia not being reproducible experimentally also speaks in favor of the belief. So far however no specificity of the spinal-fluid picture or specificity of the blood picture has been determined, nor has any marked difference in the blood picture after

enucleation or evisceration been observed. But sufficient observations have been made to justify careful neurologic study of all sympathetic ophthalmia cases, and the addition to local therapy, in perforating injuries, of treatment directed to the meningitic process namely, repeated lumbar puncture, intravenous urotropine, and glucose and salt solutions. Evisceration should only be done in cases of panophthalmitis. Operations for traumatic cataract should not be done too early. Patients with perforating eye injuries should not be discharged as cured until there is normal spinal fluid and normal hematology. M. Davidson.

Krückmann, J. *Choroiditis guttata* (Tay) and *honeycomb choroiditis* (Doyne). *Klin. M. f. Augenh.*, 1941 v. 107, Oct., pp. 361-372.

There is a certain similarity in the ophthalmoscopic pictures of these two entities. In both there are small yellowish-gray, almost punctate, opacities in the area about the macula. In choroiditis guttata the lesions are round, sharply defined, and more definitely yellowish, sometimes with a delicate pigment border. In honeycomb choroiditis they are polygonal (so as to suggest a honeycomb when they are closely packed), are more gray, much larger, and less sharply defined at their margins. In both, the normal retinal vessels pass undisturbed over the deeply placed opacities. Equal involvement of both eyes is an essential characteristic. Choroiditis guttata begins late in life, occurs preponderantly in females, may be familial, and is associated with normal vision, dark adaptation, and visual fields. It is probably produced by a drusen-like excrescence of the lamina vitrea and has no choroidal lesions, hence Dimmer prefers to call it retinitis

guttata. In Doyné's honeycomb chorioiditis there is almost always considerable loss of vision, and in cases which were observed for a long time there was a paracentral scotoma connected with the blind spot, as well as disturbances of light and color sense. In the only case which has been available for microscopic study Treacher Collins found hyaline degeneration of the lamina vitrea and over these areas of degeneration there was destruction of the pigment epithelium and neuro-epithelium.

Since the etiology is unknown it has been impossible to correctly classify all reported cases in the literature, and there is much confusion. The author reports the five cases observed at the Munich Clinic. Two of them seem to belong to one group and three to the other. Those disturbances in an individual patient which do not seem to be part of the textbook picture of one or the other of these entities are readily explained on the basis of concurrent pathologic changes. (3 figures, references.)

F. Herbert Haessler.

Roberts, W. L., and Nielsen, R. F. Uveoparotid fever with bilateral papilledema. *Amer. Jour. Ophth.*, 1945, v. 28, Nov., pp. 1252-1255. (References.)

Vila-Coro, Antonio. Notes on the treatment of tuberculous iritis. *Klin. M. f. Augenh.*, 1941, v. 107, Aug., pp. 172-179.

It is important to be conservative in the diagnosis of tuberculous iritis. Though the typical textbook picture of iritis is rare, patients in whom it occurs respond satisfactorily to specific therapy. On the other hand, when iritis is erroneously diagnosed as tuberculous on insufficient evidence the therapeutic results are disappointing and the value

of perfectly reliable therapeutic agents are misjudged. Once the diagnosis is reliably made tuberculin and calcium therapy are indicated. If they are ineffectual, sanocrysin in small doses should be used cautiously. The diet should be carefully supervised to guard against excess weight. In all resistant cases roentgenotherapy is indicated.

F. Herbert Haessler.

8

GLAUCOMA AND OCULAR TENSION

Barkan, Otto. Goniotomy. Preliminary deepening of the anterior chamber with air or saline solution. *Amer. Jour. Ophth.*, 1945, v. 28, Oct., pp. 1133-1134. (References.)

Carreras Durán, Buenaventura. Modern orientation in the treatment of glaucoma. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1944, v. 4, July-Aug., pp. 631-714.

This is an exhaustive treatise on the care of glaucoma. The pathologic background, mode of action, and indications for employment of the various forms of medical and surgical treatment are thoroughly discussed.

J. Wesley McKinney.

Casanovas, J. Roentgen irradiation of the cervical sympathetic in treatment of glaucoma. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1944, v. 4, July-Aug., pp. 594-607.

Ten cases of glaucoma were treated by irradiation of the superior cervical sympathetic ganglion. In some of them the tension was completely normalized, while in most of them the tension was lowered and the visual acuity and field improved. Pain was relieved in several cases. The procedure has some value

as an additional antiglaucomatous measure. (10 figures.)

J. Wesley McKinney.

Dashevsky, A. I. Tonometric "expression" testing and its clinical significance in glaucoma and traumatic ocular hypotony. *Viestnik Oft.*, 1944, v. 23, pt. 3, p. 21.

Since 1939 the author has been using the elastotonometer (devised by him and described in the 1941 *Viestnik*) to secure an expression curve found useful in early diagnosis, differential diagnosis, and control of the therapy of glaucoma. The curve is the graphic record of the rate of fall of ophthalmotonus during continuous application of the elastotonometer for two minutes, noting the fall every ten seconds. It is said to help in measuring the effectiveness of filtration after operation, in deciding whether miotics alone are sufficient to control the disease, and in measuring tension in the hypotonic state. It has been noted that hypotonic eyes with good light projection show an expression curve intermediate between the normal and the glaucomatous curve. In such cases treatment with dionin, hot paraffin compresses, and subconjunctival atropine injection gave encouraging results. (Illustrated.)

M. Davidson.

Díaz Domínguez, Diego. Causes of failure of antiglaucomatous operations. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1944, v. 4, July-Aug., pp. 575-584.

Four principal causes of failure were noted in a series of 26 operations for acute glaucoma and 109 operations for chronic glaucoma. In the first group the cause of failure was use of iridectomy for a supposedly acute glaucoma which was in reality an acute superimposed upon a chronic glaucoma. Failure in

the second group was caused by waiting too long to operate in an acute attack not relieved by medical treatment. Failure in the third group was caused by injury to the lens capsule during operation for iridectomy. This complication is avoided by using the ab-externo incision. The fourth cause of failure was malignant glaucoma in which nothing seems to be of avail. (References.) J. Wesley McKinney.

Díaz Domínguez, Diego. The effect of internal administration of neurovegetative drugs on ocular tension in glaucoma. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1944, v. 4, Sept.-Oct., p. 771.

The double objective of the author's investigation was on the one hand to ascertain the vegetative disturbance of the glaucoma patient, and on the other to enlarge the list of drugs in glaucoma therapy. The material consisted only of cases resistant to local action of pilocarpine. Of drugs recommended as hypotensors in glaucoma, acetylcholine and pacyl were found totally ineffective. Hypodermic use of 0.5 mg. of eserine twice daily reduced intraocular tension in some cases and was ineffective in others. Atropine internally reduced the tension in 11 out of 17 cases, in five bringing it down to normal; the effect, however, was not lasting. In one eye in which pilocarpine locally raised the tension and intensified pain, the internal administration of atropine reduced the tension and enabled the eye to tolerate the pilocarpine. Ergotamine tartrate was found effective taken internally or injected subconjunctivally, except in eyes with advanced vascular deterioration; 1 mg. three times daily was frequently effective in cases in which the rise in intraocular tension was most marked in the afternoon. A more pronounced and lasting effect was ob-

tained with ergot alkaloids, which were found effective in cases in which gynergen failed. A combination of ergotamine, atropine and luminal was tried in 21 cases; it was ineffective in nine, effective in six, and unconvincing in six. It was ineffective in advanced cases or in cases with arteriosclerotic disturbances. Good results were obtained in cases which had been operated upon without complication but with inadequate reduction in tension. A combination of ergot alkaloids with a cholin derivative was tried in 27 cases, with transitory improvement in 3, a good result in 17, and no effect in 7. This combination of drugs was effective in cases in which each drug used alone had no effect on intraocular tension. The usual dosage was 0.5 mg. of ergot and 8 mg. of pacyl three times daily. The author is convinced that this combination is more effective than any other medication used in glaucoma, and urges its use in all cases of simple primary glaucoma in which miotics do not hold the intraocular tension within normal limits. The seven cases in which the treatment was ineffective were two of absolute glaucoma, three of acute glaucoma, one of infantile glaucoma, and one of secondary iritic glaucoma.

Ray K. Daily.

Díaz Domínguez, Diego. Ocular hypotension and primary glaucoma. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1944, v. 4, July-Aug., pp. 566-574.

The author notes that in primary glaucoma hypotension may occur spontaneously or after instillation of pilocarpine. It has also been noted in cases of glaucoma in one eye in which the other, normal eye may respond with hypotension upon instillation of pilocarpine. Such a reaction may indicate a predisposition to glaucoma, as the

tension of nonglaucomatous eye is usually not reduced by pilocarpine. The possibility of this hypotensive reaction should be kept in mind in cases of suspected glaucoma. (References.)

J. Wesley McKinney.

Krasilschikova, E. M. Carbocholin in glaucoma. *Viestnik Oft.*, 1944, v. 23, pt. 6, p. 45.

This preparation (carbaminol-chloride) used in twenty cases proved the most active of miotics. Its use makes pilocarpine more effective. When used immediately after tonometry general vagotonic effects were noted in the form of sweating, dizziness, salivation, nausea, and colic. This is attributed to sensitization by tonometry, and use of the drug is recommended not earlier than half an hour after tonometry.

M. Davidson.

Moreu, Angel. Fundamental basis of glaucoma therapy. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1944, v. 4, Sept.-Oct., p. 745.

The author believes that the basis of glaucoma is an endocrine organo-vegetative disturbance affecting the oculo-vascular circulation. The oculo-vascular equilibrium of the eye is maintained by coördination of the ocular sympathetic and parasympathetic regulators, which are themselves subject to the influence of the endocrine glands. For etiologic therapy it is important to determine whether it is the function of the sympathetic or of the parasympathetic that is at fault. In the former the dominating process is vascular spasm with arterial hypertension, and the rise in intraocular pressure is caused by the secondary vasodilatation which follows every adrenergic vasoconstriction. In irritation of the parasympathetic there is primary vaso-

dilatation, and the slightest obstruction to venous drainage may upset the intraocular balance.

Another factor of therapeutic importance is the degree of adequacy of the intraocular venous and aqueous drainage. This is ascertained by gonioscopy and a fluorescein test used in the following manner: Five c.c. of fluorescein sodium is injected intramuscularly, and the patient placed immediately at the slitlamp. He is examined every half hour for the appearance of fluorescein in and its disappearance from the aqueous. The earlier it appears in the anterior chamber, the greater the vascular permeability and the more profound the vascular changes. The more rapidly it disappears, the more adequate the intraocular aqueous drainage. The higher the tension, the greater the drainage at the iridocorneal angle, a fact proved gonioscopically by the spot of fluorescein in the angle and by the green color in Schlemm's canal. In glaucoma with low tension and good drainage fluorescein is rarely found in the angle. This test has also a prognostic value; the later the fluorescein appears, and the faster it is eliminated, the better the prognosis.

Under treatment, in addition to local, hygienic, and dietetic regime, the author lays great stress on the importance of general medication acting on the neurovegetative system. The parasympathomimetics or cholinergics act by producing a primary vasodilatation without vasomotor paralysis; experimentally their oral, subcutaneous, or venous administration had no effect on intraocular tension even if the vascular pressure fell so low that the animals died. The author condemns the use of calcium in glaucoma. Cases with

obstruction to intraocular drainage, aqueous or vascular, belong to the domain of surgery. Ray K. Daily.

Moreu, Angel. Modern orientations in the pathogenesis and treatment of glaucoma. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1944, v. 4, July-Aug., pp. 548-565.

The author sets forth a working hypothesis which, he states, helps to elucidate the pathogenesis of glaucoma. Upon this hypothesis a system of treatment is based. It has been noted that in the preglaucomatous state the light threshold is lowered and dark adaptation retarded. These functions are tied up with the vitamin-A content of the retina and the melanotropic hormone produced by the hypophysis, which is regulated by the optic nerve itself and the cervical sympathetic. It is supposed that a sympathicotonus invariably exists in glaucoma, and that as a consequence the vascular bed of the uvea and retina is reduced and gives origin to a vitamin-A deficit in the retina. Vasoconstriction in the hypophysis produces diminution of production of the melanotropic hormone. This explains the alterations of the light threshold and dark adaptation in preglaucoma. After a time there is a paralytic vasodilatation especially affecting the ciliary body, with edema of the ciliary body and excessive transudation of blood plasma which cannot be carried away rapidly enough by the drainage channels. At this point hypertension ensues. Basing treatment upon the above outline concept of the pathogenesis of glaucoma, the author administers continuously the sympathetic depressant, gynergen, sometimes with the parasympathetic stimulant acetylcholine. Nicotinic acid is given for its

vasodilator effect. Treatment during the stage of hypertension is not discussed. (10 graphs.)

J. Wesley McKinney.

Palomar Palomar, Alejandro. *Cyclodiathermy punctures of Vogt in the treatment of glaucoma.* Arch. de la Soc. Oft. Hisp.-Amer., 1944, v. 4, July-Aug., pp. 608-617.

Discussing the mode of action and technique of Vogt's diathermy puncture the author gives the following indications for the operation: (1) hemorrhagic glaucoma, (2) acute glaucoma after medical treatment and iridectomy have failed, (3) glaucoma secondary to iridocyclitis in which iridectomy has failed, (4) painful absolute glaucoma, (5) glaucoma in aphakia and subluxation of the lens, (6) glaucoma with adherent leucoma after failure of iridectomy, (7) glaucoma in which the anterior chamber has disappeared, (8) glaucoma with markedly constricted fields in which other anti-glaucomatous operations may endanger the remaining field, (9) every case of glaucoma which other operations have not arrested the functional deterioration. (2 tables.)

J. Wesley McKinney.

Palomar Palomar, Alejandro. *Results of Vogt's cyclodiathermy in the treatment of hydrophthalmos.* Arch. de la Soc. Hisp.-Amer., 1944, v. 4, Sept.-Oct., p. 788.

The author reports four cases, one bilateral. In four eyes this procedure was the first operation, while in one eye it followed an unsuccessful Elliot trephining. In three eyes tension was reduced to normal and in two eyes the operation failed. The author believes that in infants this procedure reduces

intraocular tension as well as in adults. If successful the result is lasting, and the evolution of the glaucomatous process is arrested. Since most cases of infantile glaucoma are first seen in already advanced stages, when sclerectomy is dangerous, cyclodiathermy is here indicated as the first operative procedure; and in most cases it will save whatever vision is present. If there is any question as to its indication as the primary procedure, the author believes there can be no argument as to its indication in cases where sclerectomy or cyclodialysis has failed. In hydrophthalmos he considers this the operation of choice. Ray K. Daily.

Pérez-Buñil. *Extraction of the vitreous humor in the treatment of acute glaucoma.* Arch. de la Soc. Oft. Hisp.-Amer., 1944, v. 4, July-Aug., pp. 618-620.

In a case of glaucoma following corneal ulcer and iris incarceration, and in another case of acute glaucoma, about 0.7 c.c. of vitreous was removed through a large needle. In both cases the tension was temporarily normalized. In the first case iridectomy and in the second trephining was later done with good results

J. Wesley McKinney.

Romero, Eduardo. *Hypertension of the sympathicoradial system.* Arch. de la Soc. Oft. Hisp.-Amer., 1944, v. 4, Sept.-Oct., p. 797.

In the author's conception of the pathogenesis of glaucoma, the rise in intraocular tension in simple glaucoma is attributed to a spasm of the radial fibers of the ciliary muscle, innervated by the sympathetic. The theory is that the circular and radial fibers of the ciliary body are antagonists; the cir-

cular fibers functioning in accommodation for near and the radial in accommodation for distance, spasm of the radial fibers producing a fixed spasm of accommodation for distance, with a dilated pupil! The radial fibers we are told, are inserted into the tendinous ring of Dollinger, which forms the posterior wall of Schlemm's canal; their contraction creates mechanical obstruction to intraocular drainage and a consequent rise in intraocular tension. The effectiveness of surgical procedures such as iridectomy and cyclo-diathermy is attributed to destruction of the insertion of these fibers. Cyclo-diathermy destroys the fibers directly. The mydriasis of glaucoma is regarded as an expression of sympatheticotony affecting the radial ciliary and iris fibers.

Ray K. Daily.

Rossi, Silvano, Roentgen irradiation of the cervical sympathetic in glaucoma, *Arch. de la Soc. Oft. Hisp.-Amer.*, 1944, v. 4, July-Aug., pp. 585-593.

This is a preliminary report based on the treatment of 18 cases of glaucoma by irradiation of the superior cervical ganglion. The results were encouraging. In the first few hours after irradiation there was usually a slight mydriasis with an increase in tension which lasted for a few hours. This phase was followed by miosis and lowering of tension. It is established that the autonomic nervous system has much to do with regulation of the ocular capillaries, ciliary body, and pupil, and thus the intraocular pressure. Glaucoma is thought to be due, at least in part, to imbalance of the autonomic nervous system. The action of X ray is selective, reducing the hyperfunctioning elements to normal. It is suggested that a single group of cells

may become hyperexcited, and that X ray in suitable doses acts only on this group of cells and not on the normal cells. (One graph.)

J. Wesley McKinney.

Vishnievsky, N. A. The diagnostic role of elastotonometry. *Viestnik Oft.*, 1944, v. 23, pt. 4, p. 15.

Elastotonometry, first proposed by Filatov, is believed to be a valuable aid in the diagnosis of incipient glaucoma but cannot be depended on exclusively for such diagnosis. Its basis is believed to be a change in plasticity of the ocular tissues. Experiments on rabbits, in which the fifth or upper cervical sympathetic was sectioned on one side, showed no appreciable effect on the curve. Nor was any effect noted on tonograms from repetition of the same weight or from changing the order of procedure from high to low heights or vice versa. Clinical application of the method in 117 glaucoma cases, with an incidence of hypertension in 39.8 per cent resulted in typical elastotonometric curves in 76 per cent of the cases. (Elastotonometry studies the rate of reduction of intraocular tension from application of increasing weights at regular intervals over a certain period.)

M. Davidson.

Wagner, H. Kerbacher, P., and others. Survey of operative results in over two hundred cases of chronic glaucoma treated with cyclodiathermy puncture at the University Eye Clinic, Zurich. *Klin. M. f. Augenh.*, 1941, v. 107, Nov., pp. 457-480.

Statistical compilation of the cases of chronic glaucoma treated with Vogt's cyclodiathermy puncture during the years 1936 to 1941, at the University Eye Clinic of Zurich, Switzerland, including Vogt's private patients. Most

of the cases had been operated upon previously by various methods and many were absolutely hopeless (lack of anterior chamber, hemorrhagic glaucoma, glaucoma from venous thrombosis, persistent high tension in spite of all surgical and medicinal treatment). In one of Vogt's private cases a hypopyon keratitis occurred two weeks after the operation. Otherwise not a single infection was observed. In many instances one cyclodiathermy puncture gave the desired result; in others more such operations, up to a maximum of nine, became necessary.

The following precautions are essential: perfect asepsis; strict care as to the length of the diathermy needles (not more than 0.5 mm.); keeping at least 3 mm. from limbus, to avoid lens injury and corneal lesions.

Cyclodiathermy puncture affords a patient with malignant glaucoma, uninfluenced by any other means, a fair chance not only to avoid enucleation but to preserve the function of the glaucomatous eye over a long period. The method is also suitable for painful absolute glaucoma. (2 tables.)

F. Nelson.

9

CRYSTALLINE LENS

Bischler, Vera. **Congenital total diffuse cataract.** *Klin. M. f. Augenh.*, 1941, v. 107, Dec., pp. 571-574.

The author reports on a cataract which was presumably inherited dominantly through four generations. Only one child was examined: a parent and the grandparents were aphakic and a great-grandfather was said to have had cataract. The child in question had a diffuse opacity of practically the entire lens. Only the central pellucid interval and the very narrow band between

the capsule and the subcapsular plane of cleavage were relatively clear. This is a more severe defect of the eye than the diffuse nuclear cataract described by Vogt, in that the patients had nystagmus, amblyopia, and a barely visible disturbance of the macula (the latter seen in the mother of the patient). On the other hand no retinal detachment complicated the operation. Vogt thought that his patients were predeposited to that complication. (3 figures, references.)

F. Herbert Haessler.

Cartwright, G. E., Wintrobe, M. M., and others. **Anemia, hypoproteinemia, and cataracts in swine fed casein hydrolysate or zein. Comparison with pyridoxine-deficiency anemia.** *Jour. Clin. Investigation*, 1945, v. 24, May, p. 268.

Swine maintained on a synthetic diet in which protein was supplied in the form of an acid hydrolysate of casein, or by feeding zein, failed to grow and developed an anemia. Lens opacities formed in two out of three pigs maintained on acid hydrolysed casein and in two out of three animals fed zein. The cataracts involved the posterior cortex and the suture lines. It is thought that the changes are caused by tryptophane deficiency. Although faulty tryptophane metabolism occurs in pyridoxine deficiency comparison between tryptophane and pyridoxine anemia reveals marked differences. A hypothesis is offered to explain the role of tryptophane and pyridoxine in hematopoiesis. The data presented suggest that a low intake of tryptophane retards the course and diminishes the severity of the nutritional disorder due to pyridoxine deficiency in swine.

Robert N. Shaffer.

Meyer, Gerhard. **Marfan's syndrome and spontaneous dislocation of the lens.** *Klin. M. f. Augenh.*, 1941, v. 107, Dec., pp. 580-584.

In four of five patients a spontaneous luxation of the lens into the vitreous produced a satisfactory visual acuity relatively early in life. With progressive displacement of the lens it is wise to postpone the highly dangerous extraction. The fifth case confirms this warning. The right eye became blind after operation. Dislocation of the lens into the anterior chamber is extremely rare in Marfan's syndrome. Pilocarpine is indicated in cases where this possibility suggests itself. (7 figures.)

F. Herbert Haessler.

Roethth, A. F. M. de, and Greene, P. B. **Rubella cataract.** *Northwest Med.*, 1945, v. 44, July, p. 222.

The historical background and the syndrome of rubella cataract are discussed. These congenital cataracts are due to infection of the mother by rubella particularly in the early months of pregnancy. Frequently associated are heart lesions, mental deficiency, and microcephaly. Therapy is surgical and linear extraction is preferred to discission, because of the toughness of the capsule. Two cases are reported.

Robert N. Shaffer.

Rosen, Emanuel. **An atypical case of Marfan's syndrome.** *Amer. Jour. Ophth.*, 1945, v. 28, Oct., pp. 1134-1138. (7 figures.)

Schönfeld, W. **Lichen disseminatus Vidal (neurodermatitis disseminata) and lenticular opacities.** *Klin. M. f. Augenh.*, 1941, v. 107, Dec., pp. 589-597.

Fifty-two cases of Lichen disseminatus Vidal have been reported and

this author adds five more. In two of his patients the associated cataract may have been a coincidental manifestation, and it is right to assume that this may also be true of some of the cases recorded in the literature. In three of his patients, however, the cataract was diagnosed by a colleague as cataracta dermatogenes. How the lesions of skin and eye are related has not been demonstrated. All of the author's patients who had cataract had also rather severe involvement of the skin, particularly on the face, and two patients had other allergic phenomena as well. The dermatologists are rather inclined to consider the skin lesion allergic in origin. It is possible that the ciliary epithelium becomes so altered that it allows anaphylactic antibodies to enter the aqueous from the blood and thus influences the metabolism of the lens. (Bibliography.)

F. Herbert Haessler.

10

RETINA AND VITREOUS

Arruga, H. **A diathermy apparatus for retinal detachment.** *Arch. de la Soc. Hisp.-Amer.*, 1944, v. 4, Sept.-Oct., p. 741.

Arruga has designed a simple diathermy apparatus with an output of 60 to 120 ma., adequate for diathermy coagulation in retinal detachment. The apparatus consists of a transformer of 125-2000 volts, a tungsten spark plug, three fixed condensers, a coil, and a rheostat. The accessories comprise a pedal for foot control, a neutral pad-electrode, cords, and a handle for the active electrodes. These last are straight and curved, olive tipped for coagulation, and sharp for perforation, and are insulated with glass.

Ray K. Daily.

Bartels Martin, **Accidental injury and retinal detachment.** *Klin. M. f. Augenh.*, 1941, v. 106, June, pp. 684-695.

We know nothing definite about the genesis of spontaneous retinal detachment. We know statistically that certain conditions favor its occurrence, and it is obvious that there must be varied opinions on the part that accidents play in its production. All we really know is that old and myopic eyes are more apt than others to have retinal detachment. It is not known whether a severe or slight or moderate myopia is most predisposed. Nor is it known whether degenerative changes associated with myopia make an eye more disposed and if so which changes, those of retina or of choroid. It is assumed that cystoid changes in the retina are particularly predisposed, but the author points out that cystoid degeneration is found also in normal eyes and even in youth. Nor is cystoid change in one particular area or stratum of the retina known to be particularly associated with retinal detachment.

To shed light on this problem Bartels selected for analysis 101 cases of his 417 in which trauma was mentioned. He concludes that after blunt injury there is almost always an interval between the trauma and development of the detachment. In cases ascribed to injury caused by heavy lifting or stooping he can see no connection but the detachment is almost always reported to have occurred immediately after the injury. This is also true of blows on the head. His conclusion from this experience is that when disturbance of vision is noted immediately after injury—aside from direct perforation or severe compression of the globe—the

injury has nothing to do with the detachment.

F. Herbert Haessler.

Franceschetti, A., and Babel, J. **Hemeralopia congenita and retinitis pigmentosa in a sister and a brother.** *Klin. M. f. Augenh.*, 1941, v. 107, Nov., pp. 506-521.

After discussion of the literature the authors report the cases of one sister with very pronounced congenital hemeralopia but without characteristic fundus changes and one brother with hemeralopia and extensive typical pigment degeneration of the retina. They conclude that from the clinical as well as the genetic standpoint congenital hemeralopia belongs to the group of retinitis pigmentosa and related retinal diseases. They propose a new classification of these ailments. (5 figures, bibliography.)

F. Nelson.

Gonzales, M. B. **Intraocular tension and retinal circulation in pregnancy.** *Arch. de la Soc. Oft. Hisp.-Amer.*, 1944, v. 4, Sept.-Oct., 802.

The conclusions from this investigation are as follows: (1) The intraocular tension falls as pregnancy advances and returns to normal one month after delivery. (2) The pressure in the central retinal artery remains unaltered in normal pregnancy and measures 50 per cent of the pressure at the forearm. (3) In toxemia of pregnancy the diastolic pressure rises 70 to 85 per cent of the tension at the forearm. This rise in diastolic retinal pressure appears before fundus changes become evident. (4) There is no relation between intraocular tension and retinal pressure. (5) During normal pregnancy the retinal vessels are tortuous and turgescient; at the onset of toxemia

they appear narrow but slightly tortuous and the fundus is ischemic. (6) Ophthalmoscopic examination enables us to make an early diagnosis of toxemia of pregnancy. For this purpose it is absolutely necessary to determine the relation between retinal and forearm diastolic blood pressures, the rise in diastolic retinal pressure being the first indication of toxemia. (Illustration.)

Ray K. Daily.

Graff, Gerd. Periphlebitis and tuberculosis, chorioretinitis in the same eye. *Klin. M. f. Augenh.*, 1941, v. 107, Oct., pp. 348-354.

The coincidental appearance of tuberculous chorioretinitis and periphlebitis in the retina is not an uncommon occurrence, as the author shows by means of statistics from the Freiburg Clinic, but the opportunity to photograph the fundus of such an eye rarely presents itself. Graff contributes such a composite picture made up of seven carefully matched fundus photographs, so that a relatively large area of the fundus is presented. The frequent association of periphlebitis and other ocular diseases which are known to be tuberculous makes it seem unlikely that periphlebitis of the retina is a manifestation of endarteritis obliterans, but the author is even more convinced by the fact that he has not seen a single case of Burger's disease in any of the many patients with periphlebitis in the retina. (4 figures, references.)

F. Herbert Haessler.

Karbacher, Paul. Retinal detachment and indirect trauma. *Klin. M. f. Augenh.*, 1941, v. 107, Sept., pp. 240-245.

After discussing various opinions concerning recognition of indirect trauma, especially to the head, as at

least an inducing factor for subsequent development of retinal detachment, the author reports briefly three cases of young (18 to 25 years) and absolutely emmetropic patients who developed retinal detachment following more or less severe head injury. (1 table.)

F. Nelson.

Lampert, H. The problem of clot shrinkage and its significance in retinal detachment. *Klin. M. f. Augenh.*, 1941, v. 106, June, pp. 625-638.

The author reports some of his experiments with silicate gel, particularly as to variations in the coagulum with changes in hydrogen-ion concentration. Passing an electric current through a solution caused the gel to adhere to the anode and to disappear from the cathode. Extending these experiments to blood in excised veins, it was possible to recanalize a clot and thus cause it to adhere to the vessel wall, preventing embolism. The relation to retinal detachment is discussed in a short paragraph in which the author states that the vitreous can be considered as a gel. The experiments have not yet been carried out as to the vitreous but information so obtained might throw light on moot points in the problem of retinal detachment (2 tables, 5 figures, bibliography.)

F. Herbert Haessler.

Meyer, W. An atypical case of retinitis punctata albescens. *Klin. M. f. Augenh.*, 1941, v. 107, Nov., p. 526.

A 42-year-old male, whose case had been diagnosed as one of retinitis pigmentosa when he was 17 years old, presented in the fundus a picture of rather typical retinitis punctata albescens. However, all functions were normal, including visual acuity, visual field, color perception, and dark adapta-

tion. There were no eye disturbances in the family. The condition was probably multiple drusen formation which did not impair any of the normal functions of the eye. F. Nelson.

Polojinteva-Demina, S. P. Vitamin-A starvation in adolescents, and effectiveness of carotene from pine needles in its treatment. *Viestnik Oft.*, 1944, v. 23, pt. 6, p. 38.

The examination of 136 children, one group in a school attached to a home for children and the other in a regular school, showed 9.8 percent suffering from lowered dark adaptation, and a low level of adaptation in 30.8 percent more. Those in the home fared better than the other group. Marked improvement of dark adaptation was noted in 14 out of 15 children in 5 to 14 days under use of carotene from pine needles. This improvement slowly disappeared on withdrawal of carotene. Fatigue after study periods was noted to influence adaptation. The testing was done with the Kravkov-Vishnevski apparatus, which, because of its portability and the speed with which the test can be administered, was found an excellent means of mass examination for early detection of lowered adaptation. M. Davidson.

Rieger, Herwigh. On the question of heredity in spontaneous idiopathic retinal detachment. *Klin. M. f. Augenh.*, 1941, v. 106, June, pp. 638-684.

In this 45-page lecture the author thoroughly discusses the part that heredity may play in the genesis of retinal detachment and critically evaluates the extensive literature on the subject. Vogt's views on the relationship between heredity, presenile degenerative changes, myopia, and retinal detachment are stated fully, but

the author does not believe that Vogt's position is very secure. Bartel's analysis of 500 to 600 cases of detachment suggest that familial occurrence of detachment must be quite rare. The author reports two family trees constructed from his own observations and lists about forty published by others. A report by Cibis has particular significance in that young hyperopic twins had similar detachments.

Detachment of the vitreous, however important, cannot be the only factor. It has been frequently demonstrated in eyeballs with disease of the choroid and the outer retinal strata, without any suggestion of detachment.

The author discusses the question whether one must assume the existence of a specific or nonspecific hereditary basis for idiopathic retinal detachment associated with myopia. Though nothing is proved he thinks it at least likely that a hereditary factor exists for production of the detachment that accompanies myopia. The particular manifestations which bring about hereditary detachment need probably not to be sought in the vitreous but in the retina itself. Abnormality of the glial tissue might be the basis of a progressive degenerative change in the retina comparable to abiotrophies of the central nervous system, in particular tapetoretinal degeneration. Clinically the detachment associated with myopia is characterized by almost constant presence of vitreous detachment, by a much greater incidence of retinal tear, and by much less developed histological changes in the region of the hole. The hereditary factor seems for the most part dominant but occasionally recessive. (2 figures, bibliography.) F. Herbert Haessler.

Rieken, H. A method of objective

adaptometry. *Klin. M. f. Augenh.*, 1941, v. 107, Sept., pp. 306-316.

The author adds to the communication given in his previous article (*Amer. Jour. Ophth.*, 1945, v. 28, Dec., p. 1401.) and offers further critical study of the method.

Rosenblum, M. E. **Localizing diathermy coagulation.** *Viestnik Oft.*, 1944, v. 23, pt. 4, p. 19.

While localization by means of the ophthalmoscope is quite adequate for fundus lesions, such as tears and foreign bodies, correction of ophthalmoscopic localization is often indicated, particularly when an incision has to be so made as to spare the larger retinal vessels. For this purpose a localizing diathermy coagulation with ball electrode achieves greater accuracy. It produces in the fundus a yellowish spot which serves to control the incision. It has been found useful in extraction of magnetic foreign bodies by the posterior route, in extraction of nonmagnetic foreign bodies, and in extraction of subretinal cysticercus. Ophthalmoscopy during operation is not easy, but it is facilitated by doing it as soon as possible after the beginning of the operation and by attention to the cornea to prevent its drying.

M. Davidson.

Vancea, P. **The retinal hemorrhages of the new-born.** *Klin. M. f. Augenh.*, 1941, v. 107, Sept., pp. 272-274. (See Section 16, Injuries.)

Vilenkina, A. J. **The eye findings in war nephritis.** *Viestnik Oft.*, 1944, v. 23, pt. 6, p. 35.

Among 58 cases studied ten were found with transient insignificant changes, and ten others with more marked changes, consisting of peri-

papillary retinal edema and narrowing of arteries. In only one case was there a true angiospastic neuroretinopathy. The conclusions as to prognosis are that the presence of permanent retinal changes represents a primary hypertension and poor prognosis, rather than a primary chronic nephritis.

M. Davidson.

11

OPTIC NERVE AND TOXIC AMBLYOPIAS

Kenel, C. **A case of eclampsia with papilledema and retinal detachment.** *Ann. d'Ocul.*, 1940, v. 177, no. 5, pp. 187-194.

Following lumbar puncture, severe papilledema in both eyes disappeared in several days, and in ten days both retinas were completely reattached. Two months later vision was normal in both eyes. The ocular condition was basically due to cerebral hypertension. (13 references.) Charles A. Bahn.

12

VISUAL TRACTS AND CENTERS

García Miranda, A. **The central scotoma as an early symptom in the diagnosis of intracranial affections.** *Arch. de la Soc. Oft. Hisp.-Amer.*, 1944, v. 4, July-Aug., pp. 465-474.

The finding of a central scotoma with or without papilledema or temporal pallor of the disc is usually indicative of an optic neuritis. Not infrequently, however, this loss of central vision is the first sign of an intracranial neoplasm which may be amenable to treatment. Further, opticochiasmatic arachnoiditis, tabes, and vascular lesions of the circle of Willis may be causative. Illustrative cases are cited. (4 figures, references.)

J. Wesley McKinney.

Giridhar, P. D. **Psychotherapy in hysterical amblyopia.** *Indian Jour. Ophth.*, 1945, v. 6, July, pp. 32-33.

The author relates three cases of hysterical amblyopia and one of hysterical amblyopia with monocular ptosis, all treated with immediately satisfactory results by means of subconjunctival injection of 1-percent salt solution, whose application had followed assurance that "a new and special medicine" would bring back the vision immediately. W. H. Crisp.

Kopil-Levina, E. A., and Shershevs-kaya, O. I. **The diagnosis and therapy of functional ocular affections in war-time.** *Viestnik Oft.*, 1944, v. 23, pt. 5, p. 31.

Only eight cases of ocular neurosis in the material of three hospitals were noted. Interesting observations made on them were as follows. In the first place, in contrast to some statements in the literature, there was not noted any indifference of the patients to their plight or its duration, but on the contrary serious concern and an adequate psychic reaction to their functional derangement, and a sincere and exuberant joyfulness on their recovery from it. In the second place, purely functional visual field contraction is rare, and those resting on an organic basis are the majority. In the functional disturbances of central vision, there was noted as a rule an analgesia of the lids and orbit having a definite form of "spectacles" in bilateral cases and of a "monocle" in unilateral cases, that is where one eye had been enucleated. Hypnopsychotherapy not only restored vision to normal but eliminated the analgesia, without special reference to it by suggestion. Ordinary psychotherapy, without resort to hypnosis, gave no results. These cases had been

considered from four to eight months as organic cases, and it is believed that an earlier diagnosis would have cured them much earlier. The difficulties in diagnosis resulted from accompanying injuries of the face with possible organic sensory disturbance. The evolution of most cases was slow, and the rapidity of onset of the functional disturbance after the trauma is not an absolutely necessary clue to diagnosis. Correct diagnosis is important in that the other neuroses such as functional deafness, are liquidated simultaneously with the ocular neurosis, and the results influence favorably recovery from simultaneous organic affections. In one case, the suggestions given during hypnosis were made through an interpreter, with equally good results. Usually two sessions of hypnotic suggestion, by a method here referred to as that of Kopil-Levina, but not further described, were sufficient to restore vision from defective light projection, in some cases to normal. In two of the eight cases, with visual-field contraction only, suggestion alone was effective. One case was diagnosed as simulation, and restoration was effected by an order to return to duty. In this case no lid analgesia was elicited, but the patient alleged inability to open his eyes for ophthalmoscopy, and the diagnosis was based on these findings. M. Davidson.

Meyer, F. W. **Symptomatology of optico chiasmatic arachnoiditis.** *Klin. M. f. Augenh.*, 1941, v. 107, Sept., pp. 274-280.

Meyer describes the case of a man of 23 years who at 21 years rapidly developed a very marked dystrophic genital adiposis, diabetes insipidus with normal blood sugar, high spinal pressure, retrobulbar neuritis with cen-

tral scotoma, and atypical Argyll-Robertson pupils (pupils not miotic). Syphilis was ruled out serologically and otherwise. (References.)

F. Nelson.

13

EYEBALL AND ORBIT

Bielikova, L. P. The choice of material for implantation after enucleations. *Viestnik Oft.*, 1944, v. 23, pt. 6, p. 41.

On the basis of observation in 30 fat implantations, 11 implantations of sclera by the method of Medvedev, and 11 implantations of cadaver costal cartilage as suggested by Sverdllov, the author arrives at the conclusion that fat is the best implant. While sclera produces a good mobile stump, in some cases the postoperative edema is a disadvantage. Costal cartilage results in poor mobility of the prothesis. Only two cases of necrosis were noted in the fat implants. The presence of an inflammatory process is not considered a contraindication to use of fat.

M. Davidson.

Bursuk, G. G. Use of gastrocnemius aponeurosis in plastic surgery of the conjunctiva. *Viestnik Oft.*, 1944, v. 23, pt. 4, p. 13.

In the restoration of contracted sockets, very satisfactory results are described from use of gastrocnemius aponeurosis. It is not subject to shrinking, is viable, and retains the form impressed on it. In 10 to 14 days it assumes the color of conjunctiva. The skin incision for obtaining the aponeurosis transplant has the shape of a half ellipse with convexity below and outside the crista tibiae. This incision prevents tearing out of the sutures. The aponeurosis is sutured to the un-

dermined conjunctiva. The prothesis can be put in immediately or on the following day and the sutures taken out in four or five days. Ten case histories are given, some with contracted sockets, others with complete or partial symblepharon. M. Davidson.

Filatov, V. P. An enucleation procedure. *Viestnik Oft.*, 1944, v. 23, pt. 4, p. 3.

In war surgery, where adequate and accurate anesthesia is not always possible and where enucleation is likely to be unusually painful because of the presence of orbital scars, a modification of Tillaux's procedure has been found of great advantage in dozens of cases. This method proceeds from behind forward instead of from before backward. After undermining the conjunctiva and sectioning the internal rectus, the optic nerve and ciliary nerves are cut first, and under widest possible retraction of the lids by the assistant, the globe is dislocated outward and with the aid of a sharp double hook the posterior pole is brought forward as in neurectomy. The obliques are next cut and then the remaining recti are sectioned. In cases with scars and adhesions of the globe to the inner orbital wall, Tillaux's original method of cutting the external rectus and dislocating the globe inward may be substituted.

M. Davidson.

Jaensch, P. A. Posterior orbital cephalocele. *Klin. M. f. Augenh.*, 1941, v. 107, Dec., pp. 561-571.

In the large subject of brain herniation only two manifestations interest the oculist, namely anterior (naso-orbital) and posterior (spheno-orbital) orbital cephalocele. The latter is rare

and the author therefore records two case histories. Diagnosis depends on the observation of pulsation of the eyeball without bruit and an exophthalmos with displacement of the eye down which is easily reduced by pressure and is followed after a time by transient enophthalmos. A roentgenogram is of great value. Only 24 cases have been recorded thus far. Mortality is high. Most of the patients are young, symptoms develop very gradually, and the average duration is 14 years. The first of the author's patients is remarkable in that the disease started in early childhood after injury and now at the age of 79 years the patient still enjoys a good reputation as an active and capable business man and hunter. The other patient, a 32-year-old woman, also presented the typical clinical picture. In her roentgenogram the absence of bone is so great that it is probable the right orbit is separated from the interior of the skull only by a membrane. On stereo-plates one has the impression of looking through the skull. In both patients the roentgenogram suggests bone destruction by a malignant neoplasm, but there is no known growth that continues to exist for 30 or even 79 years. (5 figures, bibliography.) F. Herbert Haessler.

Johnson, L. V. A simple rubber form for the reconstruction of a contracted socket. *Amer. Jour. Ophth.*, 1945, v. 28, Nov., p. 1260.

Kozmin, V. I. Electrocoagulation of of the conjunctival socket in plastic operations. *Viestnik Oft.*, 1944, v. 23, pt. 4, p. 40.

Free transplants have not provided the author with permanent results in dealing with contracted sockets. The best results have been from the use of

scrotum, which is thin and elastic. Superior results have been achieved by electrodiathermy coagulation. It has the advantage of economy of palpebral tissue, rapidity of scar formation, and minimal shrinking. The conjunctiva is deeply undermined both anteriorly and posteriorly, the underlying scars thoroughly burned out, and the conjunctiva replaced (sometimes sutured). The prosthesis is immediately put in and is kept for 7 to 10 days. The result is a deep and permanent fornix holding the prosthesis well.

M. Davidson.

Senna, Sertorio. A rare and grave complication of enucleation. *Arch. de la Soc. Hisp.-Amer.*, 1944, v. 4, Sept.-Oct., p. 814.

Senna reports two cases of severe hemorrhage, one six days after the enucleation, and the second immediately after section of the optic nerve. Each was controlled by a deep purse-string catgut suture which compressed the deep orbital tissues, including the optic nerve.

Ray K. Daily.

Sudakievich, D. I. The first experience with use of plastic material for orbital prothetization. *Viestnik Oft.*, 1944, v. 23, pt. 6, p. 43.

The use of plastic material was begun in March, 1943. The addition of pigment—the most useful ones being pink and yellow—results in a prosthesis equal in semitransparency and delicacy of color to that of glycerine-gelatin. The prosthesis is attached to a spectacle frame. Because of complicating bone injuries in these cases, close cooperation between the surgeon and the prothetist is required in achieving good results. In some cases a rubber prosthesis serves best.

M. Davidson.

14

EYELIDS AND LACRIMAL APPARATUS

Awerbach, M. I. Some remarks anent Strakov's article on dacryocystitis in peace and war. *Viestnik Oft.*, 1944, v. 23, pt. 5, p. 9.

As partly responsible for the thesis of Ivanova referred to in Strakov's article (see below), the author points out that, in spite of apparent contraindications on theoretical grounds, successful rhinostomies have been performed. He suggests that the suturing is not so important as the size of the osseous window achieved, and that many operators use sutures sparingly. The author believes that he who knows how to do a dacryocystorhinostomy is capable of doing an extirpation, should the occasion present itself, but that he who has only learned to do an extirpation is handicapped in doing the other without special training.

M. Davidson.

Brown, J., and Cannon, B. Full-thickness skin grafts from the neck for function and color in eyelid and face repairs. *Annals of surg.*, 1945, v. 121, May, p. 639.

Full-thickness grafts from the neck and clavicular region have been found to give superior results in the repair of facial defects. Two main advantages are improved function and color. The color is nearly always close to that of the normal face. Good function is due to thickness and softness and possibly also the character of the skin which naturally overlies a platysmal muscle. Main areas for use are on the lids, in the canthal regions, about the ala, over the nose, and about the eyes and the angles of the mouth. The authors present diagrams and pictures,

and discuss procedures involving skin grafts in facial repair.

Theodore M. Shapira.

Davids, Hermann. Contribution concerning treatment of dacryocystitis phlegmonosa. *Klin. M. f. Augenh.*, 1941, v. 107, Sept., pp. 238-240.

Treatment is, if possible, conservative. If repeated cautious massage and poulticing fail to produce pus either upward or downward the lower canaliculus is probed, but the probe is only introduced into the sac, not into the lacrimonasal duct. While the probe is being slowly withdrawn, the author again attempts to evacuate pus by gentle massage. If that attempt is unsuccessful he tries to aspirate pus through a blunted irrigation needle. This is usually easy to do. Pus is to be expressed first every two hours, later four to five times daily, then three times daily. Apparently this routine by no means makes later operation on the tear sac unnecessary.

F. Nelson.

Hughes, W. L. Reconstruction of the lids. *Amer. Jour. Ophth.*, 1945, v. 28, Nov., pp. 1203-1211. (9 figures, references.)

Nizetic, Zdravko. Tarsal extroversion in trachomatous entropion. *Ann. d'Ocul.*, 1940, v. 177, no. 6, pp. 211-217. (See *Amer. Jour. Ophth.*, 1941, v. 24, p. 837.)

Saurez Villafrance, M. R. New contributions to palpebral surgery. *Arch. de la Soc. Hisp.-Amer.*, 1944, v. 4, Sept.-Oct., p. 816.

The distinctive features of the author's technique are: (1) Preoperative preparation of the forearm from which the grafts are cut; the arm is dressed

with an antiseptic dressing for four days preceding the operation. (2) Forceps which the author devised for holding the graft; they are similar to hemostats except that they end in sharp cross-action prongs; the one-pronged model is used for small grafts, while the two- and three-pronged instruments hold larger grafts. The claim made for them is that they minimize the trauma to which the grafts are subjected in holding, and thus reduce the danger of necrosis. (3) For cicatricial ectropion of the lower lid the author uses Elschmig's free transplants. (4) For restoration of the lower lid and conjunctival sac he resorts to a combination of a deep free graft, a superficial sliding graft, and the lower third of the tarsus of the upper lid. (5) Repair of traumatic coloboma of the lids is done with the sliding flaps of Celsus and Knapp and excision of Burrow's triangles, supplemented by a third fatty-cutaneous flap from the cheek. (Illustrations.) Ray K. Daily.

Soria. Twenty years of dacryocystorhinostomy. *Arch. de la Soc. Hisp.-Amer.*, 1944, v. 4, Sept.-Oct., p. 807.

Soria reviews briefly the evolution of his technique since he began the Toti operation twenty years ago. Anesthesia is achieved through the three subcutaneous injections described by Chevrier and Cantonnet for extirpation of the lacrimal sac supplemented by topical intranasal cocaineization of the operative field. The osseous orbitonasal perforation does not exceed 9 mm. in diameter, and is placed as low as possible to avoid making the lower portion of the sac a reservoir for secretion. The bone is carefully perforated with an electric trephine, supplemented by the use of a chisel if

necessary to avoid injuring the nasal mucous membrane. The posterior lip of the incised lacrimal sac is sutured to the incised nasal mucosa; the anterior lip of the sac is sutured to the periosteum at the bony opening into the nose. Suture of the skin and a compressive bandage complete the procedure. To facilitate trephining and avoid friction between trephine and bone, the writer devised a trephine tip with sawlike teeth which are inclined alternately slightly in and out. The periosteal elevator is a reduced model of the large elevators used in general surgery. A protector longer and wider than those commonly in use guards the lacrimal sac from injury during the trephining. Stress is laid on the importance of postoperative irrigation of the new drainage channel; this is begun as soon as the cutaneous sutures are removed. The irrigation cleanses the deep wound of secretions, washing them into the nose; it also stimulates epithelization of the denuded areas, and prevents development of granulomata, which might cause a poor surgical result. (Illustration.)

Ray K. Daily.

Spaeth, E. B. Acquired blepharoptosis. *Amer. Jour. Ophth.*, 1945, v. 28, Oct., pp. 1073-1087. (1 table, 49 figures, references.)

Strakov, V. P. Dacryocystitis in peace and war. *Viestnik Oft.*, 1944, v. 23, pt. 5, p. 4.

The author reviews the progress in treatment of dacryocystitis from the time, fifty years ago, when the most conspicuous group of patients in the Moscow Eye Clinic were those with lacrimal sounds in their tear passages and dark bands of argyrosis on their

faces, from the silver-nitrate irrigations to which they had been subjected down to the dacryocystorhinostomies of our days. The author believes that many cases of epiphora can be handled conservatively, and he is against the advocacy by some authorities, particularly Ivanova, of abandoning extirpation entirely in favor of dacryocystorhinostomy. The latter he believes contraindicated (1) when the canaliculi are impermeable or non-functioning, since their role in tear conduction is paramount; (2) when there is likely to be difficulty in suturing the sac to the nasal mucosa, because of atrophy or fragility of the sac wall or hydrops of the sac with diverticuli; (3) in the presence of paranasitis, especially ethmoiditis; (4) in tuberculosis of the sac or acute dacryocystitis; and (5) in the aged and feeble. Prevention of epiphora from war injuries is important, and careful suturing of canaliculus injuries is the chief means of achieving it. In 1942 and 1943, in one evacuation hospital there were performed 101 dacryocystitis operations—70 percent dacryocystorhinostomies and 30 percent extirpations. In the 12 traumatic cases extirpation and rhinostomy were equally represented. Because of scar tissue and bony deformations in these cases canaliculorhinostomies had to be performed. In the absence of studies of end results of rhinostomy in the U.S.S.R. the author believes that the young ophthalmologist should be trained in sac extirpation and that a well-done extirpation is better than a poorly done dacryocystorhinostomy. M. Davidson.

15

TUMORS

Goodsitt, Edward. Metastatic carcinoma to the choroid arising from the

lip. Amer. Jour. Ophth., 1945, v. 28, Nov., pp. 1256-1259. (5 figures, references.)

Kreibig, Wilhelm. The clinical diagnosis of angioma of the choroid. Klin. M. f. Augenh., 1941, v. 107, Dec., pp. 597-621. (9 illustrations, including 1 color plate, references.)

Of the fifty choroidal angiomas which have been reported since 1885 all but 15 were discovered in histologic studies of blind eyes. Of the 15 eyes which had been studied ophthalmoscopically the majority were enucleated with a clinical diagnosis of sarcoma.

The diagnostic characteristics must be evaluated with caution since most of the manifestations could also occur with sarcoma. Sooner or later an angiomatous eye leads to blindness and must be removed for painful glaucoma, hence enucleation is indicated when in doubt because the alternative diagnosis is sarcoma. The most helpful manifestation is extensive angioma of the skin of the face surrounding the eye. The color is also suggestive. It is described as pale yellowish-red with striking bluish and greenish reflexes from the steeper edges of the protruding mass. The tumor itself is always much more extensive than the protruding mass. Slight or absent pigmentation on its surface suggests angioma. An irregular knobbed surface suggests angioma. Juxtapapillary site not involving the disc also speaks for angioma. Macular degeneration with areas of cicatricial membrane is not uncommon, and occurrence during youth is suggestive.

The reported cases may be naturally divided into two classes: (1) those that are associated with facial angioma, that have had amblyopia since childhood, and that are certainly congeni-

tal; (2) those that have evidence of having had perfect vision, that have no facial hemangioma, and in which the manifestations of tumor arise later in life. The author reports in great detail clinical and histologic studies of three cases. F. Herbert Haessler.

Velhagen, K. Diagnostic puncture when suspecting choroidal sarcoma. *Klin. M. f. Augenh.*, 1941, v. 107, Oct., pp. 354-361.

Velhagen describes his findings in three cases of choroidal sarcoma where diagnostic puncture was permissible and indicated. The procedure is not without danger, because any trauma to an eye afflicted with a malignant growth increases the danger of immediate metastasis although puncture is perhaps not so dangerous as is generally believed. The procedure is particularly valuable when vitreous hemorrhage obscures the view or when a large retinal detachment accompanies a small sarcoma. As one of the author's cases shows, a retinal tear may occur even in detachment caused by choroidal sarcoma. In the first enucleation for sarcoma which he saw as Axenfeld's assistant, the condition turned out to be a simple serous detachment. If diagnostic puncture is to be done, it is important to strive to obtain a specimen of subretinal fluid with as small an admixture of blood as possible. Three examinations should be made: (1) of smears from the material obtained by centrifuging the specimen of subretinal fluid; (2) a paraffin section of the same; (3) the melanin reaction described by Cibis.

Microscopic study of the preparations referred to in (2) reveals blood corpuscles, fibrin networks, and large irregular cells, occasionally with pig-

ment and large irregular nuclei. These cells are not round or spindle-shaped as one expects from histologic preparations of the tumor. They occur singly and in clumps of various sizes. It is important to draw diagnostic conclusions only from a study of clumps of cells. The single cells may not be reliably distinguished from ciliary-body epithelium or large histocytes such as are also seen in serous detachment.

For the Cibis melanin reaction one places a drop of subretinal fluid on a piece of filter paper which has been saturated with ferric chloride. When the reaction is positive for melanin the area becomes brown and remains so. The albumin of the exudate coagulates and the brown spot becomes sharply defined. In a negative reaction the area on which the fluid was dropped becomes paler.

Two pairs of illustrations show the appearance of cells from the subretinal fluid as compared with a histologic section of tumor from the same eye. (4 illustrations, references.)

F. Herbert Haessler.

16

INJURIES

Baltin, M. M. Treatment of facial burns with Bucky's border rays. *Viestnik Oft.*, 1944, v. 23, pt. 6, p. 27.

In second-degree burns, involving lids, the use of bucky rays has proved most effective in the prevention of scar formation due to secondary infection of vesicles. The rays are analgesic, and promote rapid epithelization and drying up of secretion. Any scabs, or caking of streptocide powder, prevent penetration of the rays. Hence the method is not effective in third-degree burns. M. Davidson.

Baltin, M. M. The extraction of intraocular foreign bodies. *Viestnik Oft.*, 1944, v. 23, pt. 5, p. 20.

Difficulty in extracting with the magnet is no proof of nonmagnetic nature, as is often hastily assumed. Greater accuracy in X-ray localization is being achieved by the Comberg-Baltin procedure. Making the scleral opening as close as possible to the foreign body is perhaps more important than prophylactic electrocoagulation. Other points are discussed.

M. Davidson.

Bartels, Martin. Accidental injury and retinal detachment. *Klin. M. f. Augenh.*, 1941, v. 106, June, pp. 684-695. (See Section 10, Retina and vitreous).

Brodsky, B. S. New permanent hand magnet in the light of present-day magnet-operation methods. *Amer. Jour. Ophth.*, 1945, v. 28, Nov., pp. 1245-1251. (2 figures, references.)

Brodsky, B. S. Scleral opening in the extraction of magnetic foreign bodies. *Viestnik Oft.*, 1944, v. 23, pt. 4, p. 38.

Sectioning the sclera with a knife, whether meridionally or tangentially, has disadvantages. The foreign body may catch in the lips of the incision, and the incision has often to be enlarged to permit extraction. The author has made use of the Filatov-Martinkovsky trephine of 1.5 to 2 mm. diameter (with either a sealed partition or a movable piston inside of it) to remove a scleral disc which is sometimes left on a hinge. The choroid and retina are not opened by incision, but are perforated by the foreign body in its exit. The disc is replaced and only conjunctiva is sutured over it. In only two cases was it necessary to incise the

choroid, and in only one case was introduction of the magnet tip into the vitreous necessary. M. Davidson.

Friedman, S. J. The prophylaxis, diagnosis, and treatment of sympathetic ophthalmia in the light of further observations. *Viestnik Oft.*, 1944, v. 23, pt. 5, p. 37. (See Section 7, Uveal tract, sympathetic disease, and aqueous humor.)

Friemann, Werner. Prognosis of simultaneous eye and brain injuries. *Klin. M. f. Augenh.*, 1941, v. 107, Sept., pp. 265-271.

Friemann reports the case of a railroad worker who suffered a perforating injury of the right eyeball and orbit. A splinter, probably a piece of iron, had entered the brain and could be localized in the right temporal lobe (X ray). The vision of the injured eye was lost at once, and the eye was eviscerated because of danger of sympathetic ophthalmia. In contrast to many other observations which lead to the assumption that the prognosis of such combined injuries is usually very doubtful or hopeless, this patient did not show any neurologic or psychiatric symptoms during an observation period of 3½ years, with the exception of a moderate forgetfulness and occasional conditions which might be construed as epileptiform mental absences. (References.)

F. Nelson.

Goldfeder, A. E. Plastic operations to repair the wider palpebrofacial defects from gunshot injuries. *Viestnik Oft.*, 1944, v. 23, pt. 5, p. 27.

All defects may be classified into two major groups, of which there are several subdivisions. One group has essentially a triangular form, with apex on cheek and base corresponding

to palpebral fissure, and is the most common, 13 such cases being here mentioned. The less common group is more or less quadrangular, with a side instead of an apex on the cheek. Three such cases are cited. The principle followed was to utilize the mucosal floor of the defect to reconstruct scar tissue of the border of the defect for formation of the lower fornix, inner layer, and lid border; and a skin-cartilage flap from the ear for the outer layer. Sutures are used only when the transplant shows a tendency to shift its position with eye or jaw movements. The first group is repaired in one stage, the second in two stages, with two to three weeks interval. The first stage diminishes the area of the defect, while the second stage reconstructs the lower lid and border, out of the transplanted flap alone or in combination with mucosa. This operation is best done 4 to 5 months after injury. The contraindications are: osteomyelitic processes, dacryocystitis, excessive hyperemia of the defect, and friability of its floor. The same method has been applied to rebuilding the upper lid. The results have been highly satisfactory from the cosmetic as well as the functional viewpoint. (Illustrated.)

M. Davidson.

Hofe, K. vom. **Clinical contribution to the understanding of keratitis neuroparalytica.** Klin. M. f. Augenh., 1941, v. 107, Aug., pp. 154-159. (See Section 6, Cornea and sclera.)

Ivanova, N. K. **Magnet extraction of foreign bodies from the ciliary body.** Viestnik Oft., 1944, v. 23, pt. 6, p. 9.

In the special hospital for magnet extraction, 347 foreign bodies were extracted from eyes, and 67 attempts were unsuccessful. Extraction was di-

ascleral in 89 percent of the cases, including 8 percent from the ciliary body. Attempts in two cases to extract the foreign body from the ciliary body via the anterior route, while removing the cataractous lens were unsuccessful, but the aim was accomplished satisfactorily by the posterior route. The 30 foreign bodies in the ciliary body had entered via the cornea in 6, via the limbus in 7, and via the sclera in 17 cases. Four of them were in the opposite part of the ciliary body, and almost all in the lower part of it. The fragments varied in size from 1 by 1 mm. to 5 by 2.5 mm., the majority being less than 3 mm. Hemophthalmos was present in more than one half of the cases. Because of delays in intermediate stations, the extractions were done in one half of the cases between eight and thirty days, in the other half up to six months after injury. In a few cases the ciliary body had to be incised for removal. Magnet testing was found a sound procedure, since extraction was unsuccessful in the only two cases where the test was not positive. The eye had to be enucleated in only two cases. There were no complications otherwise. The end results however are not available, because of early transfer of the patients to rear hospitals. The author regards removal of foreign bodies from the ciliary body as no more dangerous than from other parts of the eye.

M. Davidson.

Kaminskaya, Z. A. **The surgical treatment of hemophthalmos.** Viestnik Oft., 1944, v. 23, pt. 6, p. 3.

While hemophthalmos is one of the most frequent complications of contusions and perforating injuries, neither the source of the hemorrhage nor the process of its absorption are yet quite clear, particularly with reference

to retrolental hemorrhages. According to Fuchs, hemolysis and absorption begin in three or four days, take six to eight weeks, and are accomplished by the nonpigmented cells of the ciliary epithelium. The coagula formed in the neighborhood of the source of the hemorrhage requires a longer period for disintegration and absorption. The metabolism of the vitreous is thereby accelerated, and it liquifies and becomes impregnated with fine pigment dust (visible with the slitlamp. and at times with the formation of synchysis scintillans particles. Absorption is retarded by proximity to the globe wall and lens, and by inflammatory reaction while blood from the central part of the vitreous is more readily absorbed. The main purpose of treatment - is to prevent formation of connective-tissue bands from glial proliferation, and their contraction incident to the presence of unabsorbed blood. The most effective method for stimulating absorption has been found to be Zur Nedden's aspiration of vitreous, and excellent results were achieved in 19 out of 25 cases in which this was applied. In some cases a preliminary scleral incision with a knife was used before introducing the needle. In these cases it was noted that the blood accumulation was not only in the vitreous but in the perichoroidal space, from which, before puncturing the choroid, large quantities of hemolysed blood would pour out. Aspiration was performed every six weeks, beginning with three drops and increasing to six drops. The visibility of the fundus and the visual acuity were noted to increase after the first aspiration.

M. Davidson.

Kaplan. J. Xanthopsia from chronic acridine poisoning. *Ann. d'Ocul.*,

1940, v. 177, no. 5, pp. 194-205. (See *Amer. Jour. Ophth.*, 1939, v. 22, July, p. 820.)

Katznelson, A. B. Orbit and sinus injuries with foreign bodies in the sinuses. *Viestnik Oft.*, 1944, v. 23, pt. 5, p. 14.

Thirty-six cases of foreign bodies in the sinuses and outside of them are reviewed from clinical and localization aspects. Of the nine sphenoidal cases two presented the "traumatic superior orbital fissure syndrome" with exophthalmos, ptosis, ophthalmoplegia, and neuromyolytic keratitis. In the non-traumatic syndrome only corneal anesthesia results, from involvement of the trigeminal nerve. Two cases of optic atrophy were included. The fundus lesions were usually double: one at the point of contact and the other one at the posterior pole. Recurrent intraocular hemorrhage was observed in some and was attributed to injuries to the venae vorticosae. The rhinologic symptoms were not marked. The 11 ethmoidal cases showed the most inflammatory reaction. There were five frontal-sinus cases. Among the 11 antrum cases five foreign bodies were found in the contralateral antrum. The antrum cases were characterized by neuralgia of the infraorbital nerve, and by more serious globe injuries, eight of the 11 requiring enucleation. The cerebral-contusion symptoms in all of them were rather mild.

M. Davidson.

Klien, B. A. Chronic posttraumatic syndromes leading to enucleation. *Amer. Jour. Ophth.*, 1945, v. 28, Nov., pp. 1193-1203. (3 tables, 8 figures, references.)

Kopp, I. F. The surgical problem in perforating injuries of the ciliary-body

region. *Viestnik Oft.*, 1944, v. 23, pt. 6, p. 18.

The pessimism of the past in regard to ciliary-body injuries is not valid today. It should be borne in mind that it is not the injury to the ciliary body itself but the method of handling it and its role in the supervening iridocyclitis which are important. Many apparently hopeless cases may be salvaged by proper handling of the wound. This requires careful inspection, complete analgesia, and adequate akinesia. Prolapsed vitreous should be ablated, and prolapsed ciliary body replaced if recent and excised if exposed for longer than 48 hours. A gaping scleral wound is sutured. The results of proper handlings have been as follows: Only one eye out of 11 was lost in industrial-injury cases with retained foreign bodies; while those saved were 7 cases out of 19 nonindustrial injuries without foreign bodies, late in securing treatment, and 10 already showing panophthalmitis; 22 out of 30 war injuries seen late (5 days or longer after injury); and 14 out of 18 cases seen early.

M. Davidson.

Kovalevsky, P. S. Results of secondary hermetic closure of granulating wounds of the lids and adjacent areas. *Viestnik Oft.*, 1944, v. 23, pt. 5, p. 45.

Primary suture of wounds of the lids and adjacent areas is effective only within six hours after injury. Even then, under war conditions, resulting infection undoes the work. The result is an ugly large granulating surface, which if neglected is difficult to handle afterward. Secondary suturing is however feasible within six days, or, in case of infection, within 12 days after injury. The results are smoother scars with less tendency to adhesions. At

times it is impossible to close the whole open wound, but much is accomplished by partial closure. It is helpful sometimes to freshen the borders of the defect before suturing. Granulating surfaces should be closely approximated, pockets avoided, and when it is impossible to avoid these drainage is provided for by tampon. In 187 cases this has not resulted in a febrile reaction, and the convalescence period has been hastened. M. Davidson.

Krasnov, M. L. An unusual foreign body in the orbit. *Viestnik Oft.*, 1944, v. 23, pt. 4, p. 10.

This unusual case is reported to illustrate the fallibility of X ray and anamnesis. A young soldier was injured while wrestling, in the course of which he struck his right eye and the root of his nose. The left eye became blind. The X ray was negative. Neurologic examination was negative except for ophthalmoplegia and amaurosis. The diagnosis was cerebral concussion with orbital hemorrhage. While in the hospital for observation, two weeks later, the patient developed an abscess above the inner canthus of the right eye. Incision and exploration revealed a 2½-inch piece of lead pencil which had penetrated the right orbit, passed through the ethmoids and injured the left optic nerve, with permanent optic atrophy resulting. A re-examination of several X rays previously reported as negative showed faintly the outline of the pencil with the lead traceable through it. After operation the ophthalmoplegia disappeared. M. Davidson.

Krückels, H. Burns of the eye with brilliant green. *Klin. M. f. Augenh.*, 1941, v. 106, May, p. 571.

Brilliant green is an aniline dye used

in treatment of various skin diseases, especially chronic eczema, fungus diseases, and parasitic skin lesions. Already in 1912 Römer's, Gebb's and Löhlein's experiments proved that application of a 1-percent watery solution caused chemosis in rabbits' eyes. A case is reported. The patient had been treated by an oculist for simple conjunctivitis for a considerable time. Eventually the doctor prescribed a 1-percent brilliant-green solution. There resulted severe destructive hypopyon keratitis with necrosis of the conjunctiva, terminating in bilateral blindness with good light projection.

F. Nelson.

McCulloch, Clement. **Changes at the macula due to solar radiation.** Amer. Jour. Ophth., 1945, v. 28, Oct., pp. 1115-1122. (2 diagrams, references.)

Mielke, Sophus. **Rusting of intralenticular iron splinters.** Klin. M. f. Augenh., 1941, v. 107, Oct., pp. 422-425.

Mielke describes an eye with an intralenticular ferruginous foreign body in which the significant observation was rusting of only the anterior tip of the splinter while siderosis spots were already present under the anterior capsule. It is probable that the distribution of metallic ions in the ocular tissues depends upon the action of a current and that accumulations take place behind relatively impenetrable membranes (lens capsule and Descemet's membrane in chalcosis). When an electrolyte lies in the path of an electric current it becomes a secondary conductor, that is, its end which is directly toward the anode becomes a cathode and the other end an anode. Observation of this case of intralenticular foreign body suggests

that the current flows toward the anterior part of the eye. Particles will be carried only from the anode (that is the anterior end) into the tissues, to be deposited behind the first effective barrier, the lens capsule, which is the characteristic site of siderosis spots. The author has done experimental work to elucidate these facts, but this is the first clinical observation that confirms his experiments. (1 figure, references.) F. Herbert Haessler.

Moncreiff, W. F., and Scheribel, K. J. **Penetrating injuries of the eye.** Amer. Jour. Ophth., 1945, v. 28, Nov., pp. 1212-1220. (11 tables.)

Paez Allende, Francisco. **Foreign bodies on the cornea.** La Semana Med., 1945, v. 52, Sept. 6, p. 371.

The author insists on the importance of using thorough preliminary lavage (after complete anesthetization) before employing a foreign-body needle, especially when the foreign body is in the pupillary area. W. H. Crisp.

Peter, A. L., and Rosen, E. **The importance of injecting air into Tenon's capsule even in cases of foreign bodies within the eyeball.** Amer. Jour. Ophth., 1945, v. 28, Oct., pp. 1140-1144. (4 figures, references.)

Plitas, P. S. **The extraction of non-magnetic intraocular foreign bodies.** Viestnik Oft., 1944, v. 23, pt. 4, p. 4.

The author gives a detailed statement of his own technique.

Protopopov, B. V. **Matched blood and plasma transfusion in iridocyclitis.** Viestnik Oft., 1944, v. 23, pt. 6, p. 12.

The author has used blood transfusion in traumatic iridocyclitis in 120 cases. Matched blood was used in one

hundred cases, after plasma use in twenty cases was found ineffective. In the cases with foreign-body retention, transfusion was used both before and after extraction. Local therapy when indicated was not neglected. The results in 35 cases were notably good, with relief of pain and tenderness, lessening of ciliary injection, photophobia and lacrimation, rapid absorption of exudates and hemorrhages, normalization of intraocular pressure, greater effectiveness of mydriatics, and better wound healing. Less significant improvement was shown in 44 cases. In 19 cases no improvement was noted, and two cases were worse after use. The author therefore considers transfusion useful and from experimental work on rabbits he concludes that the measure acts as desensitizer of the eye.

M. Davidson.

Radzikhovsky, B. L. **Sequestrotomy in gunshot orbital injuries.** *Viestnik Oft.*, 1944, v. 23, pt. 4, p. 34.

In one base hospital 20 percent of all gunshot orbital injuries were complicated by osteomyelitis, and 31 cases were operated upon. The best time to operate has been found to be 1½ months after injury, when all inflammatory reactions have subsided and only a fistula remains. The help of the rhinologist is invoked when the sinuses are involved, and that of the neurosurgeon when intracranial extension is suspected.

M. Davidson.

Ratinova, K. A. **Some therapeutic procedures in traumatic iridocyclitis.** *Viestnik Oft.*, 1944, v. 23, pt. 6, p. 14.

When other methods fail, two procedures have proved of benefit. (1) Decompressive scleral trephining: Based on observation of beneficial effect of attempts at removal of foreign bodies

in the presence of an inflammatory reaction, even when the attempt was unsuccessful, the author has used it in 16 apparently hopeless cases, 13 of them with nonmagnetic foreign bodies retained. A scleral flap instead of a linear incision is used. Only in four was the choroid opened. In some cases the procedure acts as would an anti-glaucomatous operation although its effect is attributed to reduction of inflammatory uveal tension. Hemophthalmos was present in three cases. Three eyes had to be enucleated. Of the rest, in two improvement ranged from light perception to hand movements. (2) Retrobulbar injection of 40 percent alcohol with 1 percent novocaine. This was used in 45 cases. It is a most potent analgesic, when for psychologic reasons enucleation is not feasible, as is the case in the young one-eyed person.

M. Davidson.

Rones, B., and Wilder, H. C. **Traumatic ocular injuries in soldiers.** *Amer. Jour. Ophth.*, 1945, v. 28, Oct., pp. 112-114. (7 tables.)

Rosenblum, M. E. **Localizing diathermy coagulation.** *Viestnik Oft.*, 1944, v. 23, pt. 4, p. 19. (See Section 10, Retina and vitreous.)

Satz, L. B. **A case of fatal purulent meningitis following an eye injury.** *Viestnik Oft.*, 1944, v. 23, pt. 6, p. 47.

In the case described an injury apparently limited to the eye, and resulting in its enucleation, led to meningitis because of an overlooked intracranial foreign body. M. Davidson.

Scharf, Josef. **Demonstration of an intraocular foreign body by means of gonioscopy.** *Klin. M. f. Augenh.*, 1941, v. 107, Aug., pp. 193-196.

A patient suffered a penetrating injury of the globe while cracking coal. It was impossible to demonstrate the presence of a foreign body with the help of the ophthalmoscope, slitlamp, or roentgen ray. The eye healed and became relatively quiet, but in four years severe inflammation reappeared. By this time gonioscopy had become available and a foreign body which had characteristics suggesting wood was seen. A piece of wood was indeed removed from the eye surgically, and, on questioning, the patient admitted that instead of striking only the lumps of coal he might have struck the wooden box in which they were stored. (2 figures.) F. Herbert Haessler.

Schmidt, Martin. **The operative treatment of corneal wounds.** *Klin. M. f. Augenh.*, 1941, v. 107, Oct., pp. 410-421.

The usual treatment of corneal laceration or perforation is to cover with a conjunctival flap. Direct suture is more difficult and takes longer to heal, but it is worthy of more extensive application to those wounds which are irregular and extensive. Suturing makes exact coaptation of the wound edges possible, and in cases where the iris is intact it makes healing possible without anterior synechia and with preservation of a normally functioning pupil. In a series of 32 cases only two eyes were enucleated and in many useful vision was retained. (1 table, 10 figures, references.)

F. Herbert Haessler.

Shershevskaya, O. I. **Ocular-fundus lesions in war injuries.** *Viestnik Oft.*, 1944, v. 23, pt. 4, p. 31.

The most common choroidal ruptures are polygonal. Holelike ruptures are seen mainly in the macula. In

dimensions they vary from punctate ruptures to those involving one half of the fundus. Hemorrhages may accompany them: these are very slowly absorbed and can be seen months afterward. When the rupture spares the outer layers of the choroid its color is yellowish it is relatively small, slitlike, or sickle-shaped, with indistinct margins and usually nonpigmented. The complete ruptures, in addition to the white color of the visible sclera, show more intensive pigmentation. Ruptures close to the optic nerve may simulate myopic changes. When in the periphery the chorioretinitic changes may simulate nontraumatic lesions. Among secondary changes may be observed an ascending atrophy of the optic nerve and a degenerative maculitis. One extremely rare case presented detachment of the pigment epithelium, in the form of a markedly depigmented disc surrounded by a dark brown ring the inner border of which was serrated and obviously elevated, while the outer border of the ring was on a level with the rest of the fundus. Retinal ruptures are considerably rarer, and are mostly in the macula, but occasionally peripheral. In the macula they sometimes simulate Kuhnt-Junius macular degeneration. They very rarely result in detachment, and heal readily with scar formation even when large. There is also marked polymorphism of macular lesions, which vary from disappearance of the physiologic foveal reflex, and macular discoloration, to large macular holes. In addition to occasional optic-nerve atrophies, three avulsions of the optic nerves were observed. All three cases were accompanied by enophthalmos and disturbed motility of the globe. The same polymorphism noted before was observed in connection with fixed and floating vitreous opaci-

ties. Occasionally an opacity would be so brightly colored as to suggest a foreign body. M. Davidson.

Shershevskaya, O. I. Physiotherapy in war injuries of the eyes. *Viestnik Oft.*, 1944, v. 23, pt. 4, p. 27.

The conditions most responsive to physiotherapy have been hemophthalmos, traumatic iritis and iridocyclitis, and injuries of the lids and neighboring parts. Hemophthalmos was favorably influenced by diathermy with subsequent iodine iontophoresis, or by galvanic ion-diathermy with iodine. Diathermy treatments of two courses of two weeks each, with an interval of two weeks between, usually seemed to help in clearing up the vitreous. Iritis and iridocyclitis have benefited considerably from galvanic ion-therapy with adrenalin or atropine (depending on indications) combined with erythema doses of ultraviolet or ultrashort-wave therapy. Suppurative wounds and hypertrophic scars of lids and adjacent parts were benefited remarkably from paraffin therapy. Paraffin can be raised to a temperature of 70 to 75 degrees C. Because it retains heat and gives it up slowly and uniformly it does not harm tissues, and its heat penetrates deeply without dilating the surface vessels. A protective plate is placed under the lids to prevent injury to the globe, and care is taken that no water drops are mixed with the molten paraffin as otherwise a burn will result. The paraffin is applied for one hour 20 to 30 times.

M. Davidson.

Tikhomirov, P. E. Salvaging the war blind. *Viestnik Oft.*, 1944, v. 23, pt. 5, p. 10.

Perforating eye injuries are the most common of all injuries in war time

and are more serious than those of peace time. They account for most of the war-blinded. Blindness resulting from eye contusions is much less frequent. In the statistics of some hospitals bilateral eye injuries are as high as 15 percent. Many of these war-blinded can be cured. The four groups in which restoration is possible are those with traumatic cataract, corneal opacities, detachment of the retina, or hemophthalmos. In the author's material, all the traumatic cataracts were the result of perforating injuries and two thirds of them were found in the only remaining eye; but only 17 of them were free from complication by other lesions. The extractions were done within one to two months in most cases, and the results do not justify the traditional practice of waiting 6 to 12 months. There is no hurry when the other eye is normal. Special care to insure results is imperative in the one-eyed. Preliminary sterilization of the conjunctival sac is necessary, and the older methods, with mercury oxy-cyanide, collargol, and quinine, were found superior to streptocide or albucid. Complete anesthesia and akinesia are necessary. The corneal section is done with a small conjunctival flap and keratome, and is enlarged with scissors when necessary. Capsulotomy is done with capsule forceps rather than with cystotome. The lens matter, often sticky, is removed with a grooved spatula aided by pressure with Daviel's spoon. The rare vitreous presentation is controlled with a conjunctival suture. Occasionally a foreign body has to be extracted from the vitreous with the electromagnet after the cataract extraction. Nonmagnetic foreign bodies have been left alone without any ill results after two years of observation. The results

of extraction are good in a majority of the cases. In one case retinal detachment followed extraction. The majority of the corneal-scar group was complicated by secondary glaucoma difficult to combat. The best results were secured from Vogt's diathermy coagulation. Keratoplasty was done in ten cases with meager results. The prognosis in operations for detachment were found best when no proliferating retinitis was present. The results in hemophthalmos cases were not encouraging, probably because the material was too old at the base hospital for successful treatment. In conclusion the author points out that one has to take a chance in cases which would be turned down in peacetime.

M. Davidson.

Vancea, P. **The retinal hemorrhages of the new-born.** *Klin. M. f. Augenh.*, 1941, v. 107, Sept., pp. 272-274.

The author systematically examined the eye grounds of 253 new-born babies delivered in obstetrical hospitals in which the best care was assured. Retinal hemorrhages were found in 27 cases (11.8 percent), 18 bilateral, 11 unilateral. In only 9 of these was premature rupture of the membrane observed. In all cases the mother's pelvis was narrow. In one case delivery was accomplished by abdominal Cesarean section. The hemorrhages often absorbed within 10 to 12 hours, usually within two or three days, in eight cases within one week, in one case within two weeks. The author believes it possible that there may be a causal connection between retinal hemorrhage of the new-born and certain amblyopias (strabismus), and also of Coats's retinitis exudativa.

F. Nelson.

Yuzefova, F. I. **An evaluation of the results of surgical and conservative**

treatment of perforating injuries of the eye. *Viestnik Oft.*, 1944, v. 23, pt. 4, p. 24.

Since there has been some discussion recently as to the value of Kuhnt's conjunctival keratoplasty in perforating eye injuries in war, the author surveyed the results in one hospital where a series of 70 cases in 1940 and 1941 had been handled conservatively, that is without resorting to keratoplasty, and another series of 70 cases in 1942 and 1943 had been handled surgically. To make the two series comparable, cases with intraocular foreign bodies were excluded. The first series showed 14 enucleations, 16 cases with vision worse as end result, 22 blind as end result; while in the second series only 6 enucleations were found necessary; only 6 resulted in blindness, and none showed vision made worse. The author therefore advocates Kuhnt's operation. But preliminary care of the wound should include excision of prolapsed tissue, and use should also be made of galvanocautery, sulfidine powder, and retrobulbar anesthesia.

M. Davidson.

17

SYSTEMIC DISEASES AND PARASITES

Friedrich, W. M. **Ocular tuberculosis in its relation to the body as a whole.** Supplement 11, *Klin. M. f. Augenh.*, 1942, Supplement 11, 126 pp.

Over 2,000 patients with ocular tuberculosis have been cared for at the institute at Höchenschwand. After the first 500 had been seen the staff at the institute was in a position to investigate and treat all the clinical material on the basis of a unified point of view. The author suggests that in all previous literature on tuberculosis it has been assumed that after an initial attack of tuberculosis in an organ all

subsequent activity of the lesion takes place in the same organ without involvement of other organs. This conception is fundamentally false. The author conceives tuberculosis as a lymphohematogenous infection which becomes manifest now in one organ and now in another. Tuberculosis is not a disease that occurs in one or more attacks, but extends over decades, sometimes throughout an entire life.

All episodes of illness of possible tuberculous etiology in the patient's history must be justly evaluated in relation to the entire picture. To make this clear the author analyzed the records of over 1,500 patients. The largest number of them were between 30 and 40 years of age, because the patients were drawn from a group of industrially insured persons. One quarter of them had iridocyclitis, and patients in whom the ocular lesions were uveal—that is, iritis, choroiditis, endophthalmitis, or generalized uveitis, constituted 705 of the total number. (Bibliography.)

F. Herbert Haessler.

Klar, R. On dentogenous focal infection in ocular inflammation. *Klin. M. f. Augenh.*, 1941, v. 107, Aug., pp. 159-165.

The author presents a rather skeptical discussion of the importance of apical dental lesions in ocular infections. His own material consists of 155 patients with ocular infections, of whom 120 or 77 percent had dental infections which in the opinion of workers in the University Dental Clinic were potential foci of infection. In 98 patients or 63 percent the dental lesion was the only potential focus found. To provide a control series the author induced the dental clinic to examine the teeth of 155 entirely nor-

mal individuals and found that 100 of them or 64 percent had similar dental lesions. (Bibliography.)

F. Herbert Haessler.

Suurküla, J. Eye diseases caused by the larva of diptera (ophthalmomyiasis). *Klin. M. f. Augenh.*, 1942, Supplement 13, 40 pp.

In this monograph the author reviews systematically the information recorded in 132 communications in the literature. In primary ophthalmomyiasis the larvae from flies belonging to the following families have been found: Tachinidae, Sarcophagidae, Calliphoridae, Oestridae, *Castrophilida*, and Phocidae. In the conjunctival sac the commonest larvae are those of *Oestrus ovis*. In the lids the larvae found in the majority of cases were *Dermatobia cyaniventris* and *Wohlfahrtia magnifica*. The same two larvae have been repeatedly extracted from the orbit, to which they probably gained access through the mucosa at the internal angle.

Thirty cases of intraocular larval invasion have been recorded. Hypoderma was the common genus, much more rarely *Wohlfahrtia magnifica*. It is highly probable that in cases where the latter larva was reported the diagnosis was erroneous, since this organism is very poorly adapted for intraocular parasitism. However, the presence of numerous larvae of this species, as well as of *Sarcophaga carnario* and *Calliphora vomitoria*, in ulcerated fistulous partially destroyed globes has been unquestionably observed. Most cases of ophthalmomyiasis are reported from southern countries. In northern latitudes infection is predominantly with *Hypoderma*, and is most common near the coast. This is the fly that causes most of the cases of ophthalmomyiasis interna. The

periodicity in the occurrence of morbid manifestations is ascribed to the gradual development of anaphylactic reactions. Inoculation presumably occurs when the adult fly in flight deposits its eggs on the surface of the tissue. Very malignant and generalized larval invasions occur only in decrepit individuals and in bodies with considerably reduced resistance. (2 tables, 12 figures, 2½ pp. bibliography.)

F. Herbert Haessler.

Szinegh, Béla. Parenteral liver injections in the diagnosis and treatment of tuberculous eye diseases. *Klin. M. f. Augenh.*, 1941, v. 107, Aug., pp. 166-172.

A patient who has tuberculosis and who does not react to intradermal injection of tuberculin is said to be in an anergic state. This is not advantageous from either the diagnostic or the therapeutic point of view. The patient is unable to produce antibodies and the injection of tuberculin is useless. The author describes the clinical course of five patients in whom parenteral injection of a liver preparation made for treatment of pernicious anemia was effective in "disanergizing" the body. The preparation (Perhepar) is used intramuscularly twice daily for a week. The liver extract produces a reticulocytic crisis. Normal control individuals remain inactive to tuberculin injection after repeated injections of liver extract. (References.)

F. Herbert Haessler.

Wegner, W. Difficulties in differential diagnosis of ocular tuberculosis. *Klin. M. f. Augenh.*, 1941, v. 107, Oct., pp. 337-348.

Since it is becoming clear that tuberculosis is the most important etiologic factor in chronic inflammatory lesions

of the interior of the eye, its importance in differential diagnosis can hardly be overemphasized. To clarify the difficulties the author records over a dozen case histories, rather briefly though in adequate detail, and discusses each. Diagnostic errors that were made because of possibly faulty examination or inadequate analysis of facts do not form part of this study. Errors may be made by dismissing too readily the importance of a personal and family history, but also by laying undue stress on these data. In three cases a sympathetic ophthalmia had been wrongly diagnosed elsewhere as tuberculosis, and in several cases a chronic internal irritation caused by an intraocular foreign body was not suspected until signs of siderosis appeared. In one case of severe bilateral intraocular inflammation in a patient who was neither underweight nor febrile, the correct diagnosis was not made until autopsy revealed a most extensive tuberculosis of all the thoracic and abdominal lymph nodes. The patient died of amyloidosis of the kidney. Atypical trachoma and syphilitic lesions of the eye may lead to serious diagnostic difficulties. In a young man of 26 years with extensive bronchial carcinoma and metastasis to the vertebrae, liver, and eyes, no etiologic diagnosis was made by either internist or oculist. After displaying this small collection of diagnostic difficulties the author is disposed to humility. (References.)

F. Herbert Haessler.

18

HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Csapody, Istvan. The professional life of the ophthalmologist. *Klin. M. f. Augenh.*, 1942, Supplement 10, 92 pp.

This well-written, readable pamphlet is presumably addressed to medical students and recent graduates who might consider preparing themselves for the practice of ophthalmology. The author describes (1) the characteristics of mind, body, and temperament that best fit a man for the specialty; (2) the course of training which will fit a candidate for surgery and consultation practice; (3) the daily routine of the eye doctor in clinic, private consultation room, hospital and surgery; (4) the person-to-person relationship between doctor and patient when preparing the patient mentally for operation or for impending blindness; and (5) the ophthalmologist's duties in giving expert opinion on matters of compensation and litigation.

F. Herbert Haessler.

Kravkov, S. V. Jan Purkinje and ophthalmology. *Viestnik Oft.*, 1944, v. 23, pt. 5, p. 3.

On the occasion of the 25th anniversary of the death of Czech scientist Purkinje, attention is called to his three great contributions to the physiology of vision. It is pointed out that the reflex images of the lens were described by him in 1825, and were later (1837) applied by the Frenchman Sanson in diagnosis; and were still later utilized by Helmholtz, who measured the changes in size of the images, in developing his theory of accommodation. The second important contribution was the construction in 1823 of the first perimeter, accompanied by many practical suggestions on performing perimetry. Aubert and Foerster to whom the first perimeter is usually credited did not act until 1857. The third very important contribution, known as the Purkinje phenomenon, and consisting in blue ap-

pearing much brighter than red in twilight, laid the foundation for the duplicity theory of Kries, and was utilized by Kravkov in exploration of dark adaptation. Other contributions of Purkinje deserving mention are his discussion of positive afterimages of the complementary color, of phosphenes from pressure and electric stimuli, of methods of entoptic examination of the retinal vascular network (which later (1872) enabled Mueller to determine the position of the pericipient layer of the retina and identify it as the layer of rods and cones), of the effect of belladonna on the eyes, of the possibility of voluntary unilateral adduction of an eye while the other is stationary, and of the physiologic substratum of sleepiness being referred to the eyes. Attention is also called to Purkinje's activities as a Czech patriot struggling against the German-Austrian oppression of his days.

M. Davidson.

Lisch, Karl. Sterilization and success of treatment in serious hereditary eye diseases. *Klin. M. f. Augenh.*, 1941, v. 107, Nov., pp. 521-526.

Reply to the critical article of R. Schmidt (see below) concerning the author's previous article on this theme. Lisch insists that it is not permissible to allow reproduction by individuals suffering from hereditary cataract of any type. "He who is doing race hygiene must never think therapeutically but only heredobiologically." It does not matter that a condition can be completely repaired, either surgically or otherwise. It is the task of a race-conscious physician to eliminate the genotype from reproduction even if the phenotype can be rendered practically normal by therapeutic means. As to the question of elimination of more or

less serious refractive errors he feels that our knowledge of the mode of inheritance of such errors is not yet broad enough to justify sterilization in such cases, unless the condition renders the patient practically blind for distance as well as for near and at least one other such case in the family is known. (References.)

F. Nelson.

Mills, E. T. Medical social work in sight conservation as developed in the State of Washington. *Sight-Saving Review*, 1944, v. 14, Winter, p. 170.

The author describes the plan of sight conservation used by the Department of Social Security, and brief individual case records show some of the end results. Francis M. Crage.

Nuri Fehmi Ayberk. Review of the history of Turkish ophthalmology from the nineteenth century to the present. *Göz Klinigi*, 1945, v. 2, no. 5, pp. 119-122; and no. 6, pp. 145-150.

In 1839 under the reign of Sultan Mahmoud II, there was inaugurated a school of medicine (at first called "justice," then "military"), directed by a Viennese physician, Dr. Bernard, in the same location as the present Galata Saray Lyceum. The teaching of ophthalmology began in this school in 1853. The official Chair of Ophthalmology was established in 1870, and was committed to Colonel Ilya Abdunnur, who had taken his training in France. Upon his death he was succeeded by Major Essad (1895), who also had specialized in Paris. In the same period a certain Behdjet taught ophthalmology to the civil medical school. In 1908, when the two schools were combined to form the faculty of medicine, General Essad and Dr. Ziya, who had studied in Germany, were ap-

pointed professors simultaneously. The first eye clinic in Turkey was inaugurated at the Military School of Medicine of Demirkapou in 1895, with Professor Essad. The previous teaching had all been theoretical.

Apart from the teaching in the military and civil schools of medicine, the Military Hospital of Haydar Pasha (1871 to 1900) and then the Military Hospital of Gulhané (1900 to 1945) were two centers where it was possible to specialize in ophthalmology. Two eminent teachers, one at the Military Hospital of Haydar Pasha, Colonel Dikran Adjemyan (1875 to 1908), and the other at the military school and Hospital of Gulhané, General Niyazi Ismet Gözcü (1909-1944), showed great scientific activity, especially the latter, who trained a considerable number of distinguished oculists. (3 photographs.)

W. H. Crisp.

Prelat, P. Ophthalmology in Paris during the war. *Amer. Jour. Ophth.*, 1945, v. 28, Oct., pp. 1088-1111.

Schmidt, Rolf. The question of sterilization of persons with "inherited cataract." (Reply to article by Lisch.) *Klin. M. f. Augenh.*, 1941, v. 107, July, pp. 67-72.

In contrast to Lisch (*Amer. Jour. Ophth.*, 1942, v. 25, p. 127), who, literally following the Nazi law of elimination by sterilization of all persons who might transmit hereditary disorders, regardless of whether or not they were curable, Schmidt advocates sterilization of all persons with "hereditary cataracts." Although advocating elimination of persons with so-called complicated cataracts, he is opposed to sterilization of persons suffering from noncomplicated simple cataracts. In this connection cataracts are to be re-

garded as complicated when the carrier is either himself mentally or physically inferior or belongs to a family the members of which frequently have cataracts complicated with such other defects as lack of foveal function, nystagmus, and additional physical or mental malformations which, according to experience, cannot be treated successfully by operation or other means. Schmidt argues consequently that higher or even medium refractive errors which render the bearer "practically blind" without therapeutic procedures (that is, corrective glasses) would have to be eliminated too, since many of these refractive errors are also inherited. (References.) F. Nelson.

19

ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Balado, M., and Fortin, E. P. Regional anatomy of the fibers of the macular area. *Arch. de Oft. de Buenos Aires*, 1943, v. 18, May, pp. 245-265.

In this article the authors study and discuss the course and arrangement of the retinal fibers, particularly those of the macular region, by means of entoptic observation and histologic preparations. The article does not lend itself to abstracting. (17 illustrations.)

Plinio Montalván.

Vidal, F., and Malbrán, J. Arrangement of the peripheral nasal bundle in the human chiasm. *Arch. de Oft. de Buenos Aires*, 1943, v. 18, July, pp. 339-345.

In a specimen from a case of optic atrophy of the left side the authors studied the arrangement of the peripheral nasal fibers in the chiasm. In the sagittal section it was observed that the lamina supraoptica divided the upper

aspect of the chiasm into an intraventricular and extraventricular portion. The nasal peripheral bundle occupied the extraventricular portion and was in close relation with the cisterna chiasmatica. In the specimen under study the bundle ran from right to left and from above downward, occupying the anterior knee of the chiasm and invading the optic nerve in an extension of approximately 500 microns, where it occupied the inner and lower aspects. This arrangement explains the prechiasmal thickening clearly seen in the sagittal section. In the two posterior thirds of the chiasm the fibers under consideration occupied the external border. (5-photomicrographs, references.) Plinio Montalván.

Vidal, F., and Malbrán, J. Studies on the chemical composition of the aqueous humor of the cat. *Arch. de Oft. de Buenos Aires*, 1943, v. 18, May, pp. 231-237.

In this article, the second of a series on the subject, the authors describe their procedure for obtaining samples of aqueous humor and the analytical methods followed for quantitative determination of sodium, chlorine, ascorbic acid, total nitrogen, nonprotein nitrogen, proteins, water and ashes, glucose, and pH. The article does not lend itself to abstracting.

Plinio Montalván.

Vidal, F., and Malbrán, J. Studies on the chemical composition of the aqueous humor of the cat. 3. Sodium and chlorine. *Arch. de Oft. de Buenos Aires*, 1943, v. 18, June, pp. 299-310.

The authors determined the contents of sodium and chlorides in the aqueous humor of the cat. They present their figures in tabulated form and compare

them with those found by other observers. The article does not lend itself to abstracting. (4 tables, references)

Plinio Montalván.

Vidal, F., and Malbrán, J. Studies on the chemical composition of the aqueous humor of the cat. 4. Protein and nonprotein nitrogen, water, and ash. Arch. de Oft. de Buenos Aires, 1943, v. 18, July, pp. 345-355.

The authors present in tabulated form the figures for protein and nonprotein nitrogen, water, and ash in the aqueous humor of the cat. The values for protein nitrogen in the primary aqueous are considerably higher than those reported by other observers. The

marked increases found by the authors in protein content in the secondary or plasmoid aqueous agree with the figures published by previous observers. The changes which the endothelial barrier undergoes after paracentesis of the anterior chamber and the formation of plasmoid aqueous are strong points in favor of the theory which considers the aqueous as a dialysate. The figures for nonprotein nitrogen are comparable to those of other observers and the proportions of nonprotein nitrogen in aqueous humor and blood found by the authors are similar to these obtained by Krause and Yudkin in the dog. (6 tables, bibliography.)

Plinio Montalván.

NEWS ITEMS

Edited by DR. DONALD J. LYLE
904 Carew Tower, Cincinnati 2

News items should reach the editor by the twelfth of the month.

DEATHS

Dr. Albert H. Aland, Los Angeles, California, died July 24, 1945, aged 56 years.

Dr. William L. Atkins, Shreveport, Louisiana, died June 16, 1945, aged 52 years.

Dr. Chester B. Bliss, Sandusky, Ohio, died July 10, 1945, aged 71 years.

Dr. William C. Brown, Oak Park, Illinois, died August 1, 1945, aged 79 years.

Dr. Henry L. Crahan, Rutland, Vermont, died July 28, 1945, aged 66 years.

Dr. George B. Crist, Frederick, Maryland, died April 8, 1945, aged 52 years.

Dr. George H. Ensminger, Chicago, Illinois, died August 23, 1945, aged 67 years.

Dr. Valentine B. Fisher, Boulder, Colorado, died August 3, 1945, aged 59 years.

Dr. William E. Foster, Babylon, New York, died August 30, 1945, aged 78 years.

Dr. Julian E. Hanna, Noblesville, Indiana, died July 29, 1945, aged 74 years.

Dr. Edward A. Hanske, Bellevue, Iowa, died June 21, 1945, aged 72 years.

Dr. William M. Holmes, Marionville, Missouri, died June 28, 1945, aged 82 years.

Dr. Douglas P. A. Jacoby, Newport, Rhode Island, died August 25, 1945, aged 72 years.

Dr. George W. Mackenzie, Philadelphia, Pennsylvania, died August 5, 1945, aged 73 years.

Dr. Jonathan T. Male, Yampa, Colorado, died July 15, 1945, aged 76 years.

Dr. John E. Manney, San Antonio, Texas, died May 27, 1945, aged 72 years.

Dr. Abraham L. Morris, Chicago, Illinois, died July 27, 1945, aged 62 years.

Dr. Edward L. Morrison, Washington, D.C., died August 14, 1945, aged 72 years.

Dr. Henry A. Shaw, Pittsburgh, Pennsylvania, died May 14, 1945, aged 63 years.

MISCELLANEOUS

Members of the San Antonio Ophthalmological Society conferred with military medical men November 13th at the Army Air Forces School of Aviation Medicine, Randolph Field, Texas, on methods of combating eye, ear, nose, and throat diseases.

Members of the teaching staff of the military installation discussed the utilization of new drugs in the prevention and control of ophtho-otolaryngologic diseases. Displayed at the conference were medical photographs and art work pertaining to eye, ear, nose, and

throat diseases. The program also featured a demonstration of a new magnetic wire recorder by Major Hubert B. Peugnet, Saint Louis, Missouri, which is used in research studies in the AAF School of Aviation Medicine Department of Otolaryngology.

Brig. Gen. Eugene G. Reinartz, Commandant of the School, welcomed the Society to the facilities of the research laboratory following a reception and dinner at the Randolph Field Officers Club.

Lt. Col. Brittain F. Payne, New York City, and Captain Fred W. Ogden of New Orleans, Louisiana, assisted Drs. Virgil S. Steele and Dan Russell of San Antonio in organizing the program.

The following courses will be given by the Harvard Medical School: March 4 to April 27, 1946—Basic science in ophthalmology; April 29 to May 25, 1946—Clinical ophthalmology; and May 27 to June 22, 1946—Fundamentals in refraction. These courses are being given at this time particularly for the men returning from the Armed Forces.

At the postgraduate courses given by the University of Buffalo School of Medicine, Dr. Walter F. King, Associate Professor of Ophthalmology, lectured on "Office management of injuries, foreign bodies, and infections of the eyes."

SOCIETIES

The officers of the Brooklyn Ophthalmological Society for the year 1945-1946 are: Dr. Michael J. Buonaguro, president; Dr. Benjamin C. Rosenthal, vice-president; Dr. Louis Freimark, secretary-treasurer; and Dr. George A. Graham, associate secretary-treasurer.

The Mississippi Valley Medical Society is resuming its annual essay contest, which has not been held during the war. In 1946 it offers a cash prize of \$100.00, a gold medal, and a certificate of award for the best unpublished essay on any subject of general medical interest (including medical economics) and practical value to the general practitioner of medicine. Certificates of merit may also be granted to the physicians whose essays are rated second and third best. Contestants must be members of the American Medical Association who are residents of the United States.

Contributions should not exceed 5,000 words, be typewritten in English in manuscript form, submitted in five copies, and must be received not later than May 1, 1946.

Further details may be secured from Dr. Harold Swanberg, secretary, Mississippi Valley Medical Society, 209-224 W.C.U. Building, Quincy, Illinois.

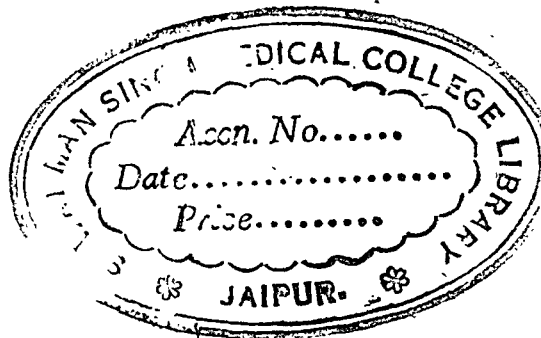
At the regular meeting of the Brooklyn Ophthalmological Society, held on December 20th, the following scientific program was given: "The so-called demyelinating diseases of the nervous system and their relationship to ophthalmology" by Dr. A. M. Rabiner, and "Arachnoiditis" by Dr. Daniel Kravitz, dis-

cussion by Dr. E. Jefferson Browder.

At the meeting of the Milwaukee Ophthalmic Society which was held on November 27th, Dr. S. S. Blankstein presented a paper on "Surgery of the lacrimal apparatus."

PERSONALS

Lt. Col. M. E. Randolph (MC), Chief of the Eye, Ear, Nose, and Throat Section at Valley Forge General Hospital, was transferred to the Office of The Surgeon General, Washington, D.C., to serve as Chief Consultant in Ophthalmology to the Surgeon General. He will be replaced by Lt. Col. Philip Thygeson (MC).



TECHNICAL REFINEMENTS IN THE REMOVAL OF MAGNETIC
FOREIGN BODIES FROM THE POSTERIOR SEGMENT
OF THE EYE*

GILBERT C. STRUBLE, LT. COL. (MC), A.U.S.

AND

LEO J. CROLL, CAPT. (MC), A.U.S.

Cleveland, Ohio

It is not the purpose of this paper to discuss the advantages or disadvantages of posterior-route extraction of metallic foreign bodies as compared to the anterior route. All authorities will agree that, in many instances, removal of foreign bodies by the posterior approach is essential. The surgical technique, experimental data, and clinical reports to be presented were for the most part accomplished with the small hand magnet.[†] The reason for this was twofold: 1. This particular magnet is the standard item of issue in Army hospitals.[‡] 2. This magnet is of the type and size in the possession of most ophthalmologists.

The military ophthalmologist has had occasion to see many patients with retained intraocular foreign bodies. In the majority of cases, our experience has shown these retained fragments to be very small, usually 1 mm. or less in size. This was in part due to the following factors: 1. The larger particles had been removed overseas. 2. Many of the eyes receiving penetrating injuries by larger fragments

had been destroyed or so seriously damaged they had been enucleated before the patient arrived at the Eye Surgical Center in the Zone of the Interior.

Some of these very tiny fragments were picked up by the use of specialized X-ray techniques. Recently we had two or three cases in which a very small particle could be seen with the ophthalmoscope floating free in the vitreous, although the most painstaking X-ray technique showed no foreign body whatsoever. Such minute particles, if magnetic, can be successfully removed.

The retained intraocular metallic foreign bodies encountered in the majority of cases seen in an Eye Surgical Center, have been present from two weeks to two or three months—not because the diagnosis has been missed, but rather because the patient had incurred other multiple serious wounds threatening to life for which other major surgical procedures had, of necessity, been required. Some of these eyes required immediate enucleation. Many, however, were in good condition. It was not unusual to find an eye with single or multiple retained intraocular foreign bodies with a vision of 20/20 and very little or almost no ocular reaction present. This is not surprising

* From the Eye Surgical Center, Crile General Hospital.

† Lancaster model with foot switch.

‡ Giant magnets are also available in Army Eye Surgical Centers.

when one considers that these patients received the attention of a well-qualified ophthalmologist almost from the first hour of the original injury. Any necessary emergency eye surgery had been accomplished immediately, with careful follow up of the case through the chain of evacuation.

In September, 1942, one of us* reported an aid in the precise localization of metallic foreign bodies embedded in the choroid and retina. In this case an officer patient was found to have a 1 by 1 by 1-mm. retained metallic foreign body embedded in the choroid and retina of the left eye, $4\frac{1}{2}$ mm. from the optic disc, in the superior nasal quadrant. The vision of the eye was 20/20. The vitreous was clear except for a few red blood cells, and very little local ocular reaction was present. The injury had been incurred five days prior to the time first seen. Because the eye became irritable and photophobic, with an increasing number of cells in the anterior segment and vitreous, the removal of the particle was thought to be imperative. The operative approach in this case called for a pinpoint localization in order to make the scleral incision directly over the retained fragment. It was believed that such an approach was indicated to prevent lateral drag on the choroid or retina, as would have been the case had the magnet been applied at a point on either side of the fragment. At the time of surgery a previously prepared lead marker affixed to an ordinary black-silk suture was sewn to the sclera at the point indicated by the X-ray localization.

The internal rectus muscle, which had been detached, was reattached with one suture and a PA and a lateral X-ray film was made in the operating room with the portable X-ray machine. It was evident

from the PA film that the foreign body had been missed 4 mm. in the vertical plane, and from the horizontal film that an error of 3 mm. in the anterior-posterior direction had been made. It was a simple matter to make the correction indicated from the known location of the lead marker and to cut down directly upon the foreign body, which was removed on the first application of a small hand magnet. Convalescence in this case was uneventful, with no evidence of vitreous hemorrhage, further damage to the retina or choroid, or late sequelae. Following this experience it became our custom to utilize a lead marker on the sclera in the majority of those cases wherein a posterior approach was indicated. This was in no way a reflection on the ability of the roentgenologist who had performed the localization. As a matter of fact, in our experience, it is often extremely difficult to mark on the sclera the exact site of the X-ray localization of the foreign body. This is due, in part, to the difficulty of picking the exact meridian indicated, and is especially true if the fragment is far posterior, and when the globe must be strongly pulled to one side. We have also found this aid in localization of great value in those cases in which the exact position of the particle was in doubt. We refer especially to those instances wherein repeated localizations may possibly vary, by one or two millimeters, but wherein this error may place the particle either in or out of the globe. Such a marker can be quickly and easily fashioned by shaving a piece of lead with a sharp knife so as to secure a fragment approximately $2\frac{1}{2}$ by 2 mm. in size. This lead fragment is fastened around and pinched on to a silk suture attached to a scleral needle. In any case the size of the marker should be distinctive and of a size differing from that of the retained intraocular foreign

* Gilbert C. Struble, read before the Indianapolis Ophthalmological Society.

body so that no confusion will arise in viewing the film taken in surgery with the portable machine as to which is the marker and which is the foreign body.

Such a procedure will, to some extent, prolong the operating time. This can, however, be kept to a minimum if a portable X-ray machine is available when needed and if rapid developer solution is used. Some additional minutes are lost in redraping the patient following the taking of the X-ray pictures during the operation, but we have found the procedure well worth the time required.

For a time we experienced difficulty in maintaining the sterility of sutures and needles attached to a resected ocular muscle during the taking of the additional films. This difficulty was solved by placing the sutures in a sterile test tube anchored to the upper lip and below the nose with a strip of adhesive plaster. Sterility of the field is maintained by placing the cassette under a sterile towel.

At the present time we have added other steps to this procedure, some of which are original and some a variation of other methods. Lancaster¹ described a modern diasclear method of extraction of foreign bodies. He advocated a scleral incision by layers with the diathermy knife, to avoid hemorrhage. He described the application of the tip of the hand magnet to the incision with extraction of the foreign body without entering the vitreous. He states the cutting current of the diathermy knife should not be allowed to act on the vitreous but does not state whether the uvea is actually penetrated and included in the section with the knife.

Verhoeff² advocates a careful scleral section under a conjunctival flap 5 to 6 mm. from the limbus and parallel to the ora serrata. He used a large knife needle, the point of which had been filed off. A careful dissection down to the ciliary

body is made, great care being taken not to penetrate this tissue with the knife. The tip of the large hand magnet is applied to the operative wound so as to pull the fragment through the ciliary body. Verhoeff states that if the foreign body is small a small cut in the ciliary body may be required to facilitate its delivery.

The following technique has, in our hands, been so uniformly successful that we feel it is worth describing in sequence.

I. PINPOINT LOCALIZATION OF THE FOREIGN BODY AS AFOREDESCRIBED. (figs. 1-6). This is essential where the foreign body is embedded in the choroid and retina: (a) To prevent lateral drag on the choroid and retina, or grooving and guttering of these layers when removal of the foreign body is attempted from one side or the other. (b) To keep choroidal or retinal bleeding to a minimum or prevent it entirely. (c) To reduce postoperative reaction and prevent late sequelae such as retinitis proliferans and retinal detachment.

II. FIXATION OF THE GLOBE, BY SCLERAL SILK SUTURES. ONE ON EITHER SIDE OF THE SCLERAL SECTION. The following advantages have been experienced: (a) Complete control of the operative area is maintained constantly. (b) Any desired amount of traction on the lips of the scleral section can be maintained during the section without instrument manipulation of the margins of the incision, and the attendant danger of nicking or penetrating the choroid or ciliary body, which is to be avoided at all cost. (c) Any desired degree of scleral separation can be maintained during the extraction of the foreign body without the use of instruments, and the operative site can be guided to the tip of the gaint magnet on those rare occasions when such an instrument is needed. (d) The sutures

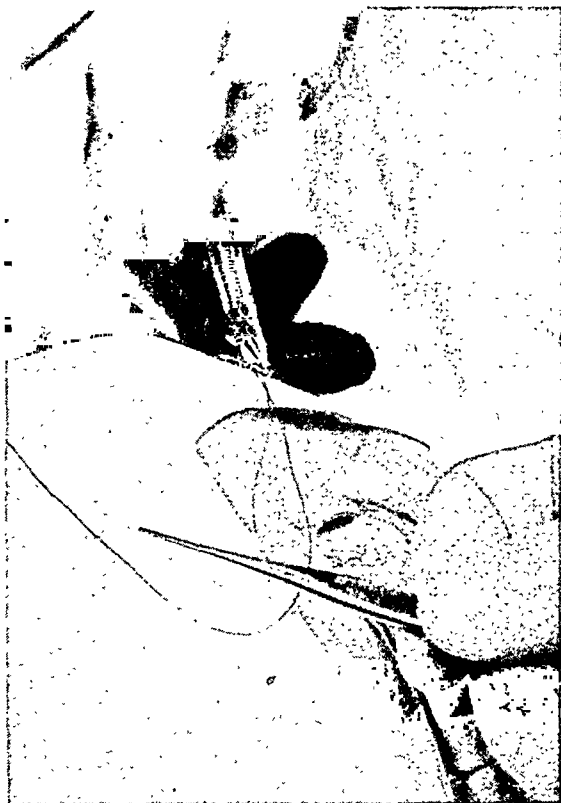


Fig. 1 (Struble and Croll). Tip of fixation forceps indicates the lead plate on a No. 6-0 black-silk suture.

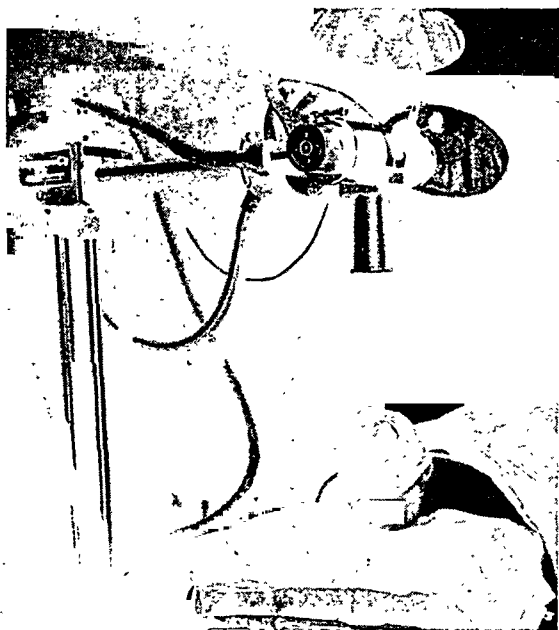


Fig. 2 (Struble and Croll). Posterior-anterior position. The cassette is under a sterile towel.

are available and ready as additional supporting sutures if desired for closing the sclerotomy incision, and as a guide suture during the application of the diathermy barrage.

III. THE SCLERAL SECTION. Using a loup, a brilliant source of light, and a cataract knife, we make a 6-mm. scleral

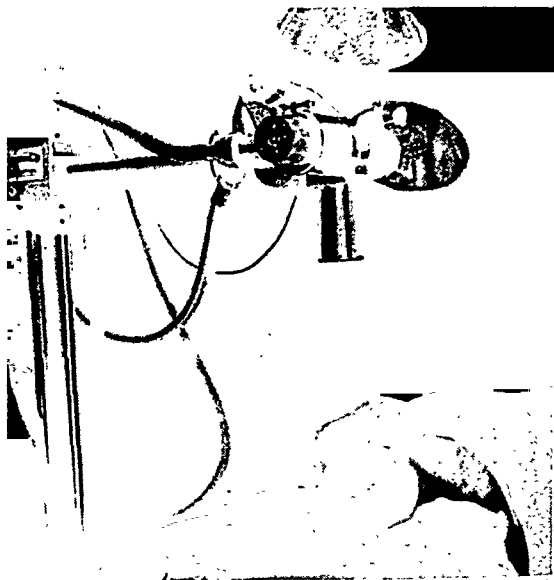


Fig. 3 (Struble and Croll). Lateral position. The cassette is under a sterile towel.

section between the scleral retraction sutures (see II). The sclera is carefully divided by layers until approximately four fifths of the thickness of the sclera has been traversed. At this point a doubled-armed, 000 plain catgut mattress suture is placed through one side of the scleral incision, involving one half of the thickness of the sclera. These sutures are carried through the opposite lip of the section and through the outer one half of the thickness of the sclera. One tie is made in the suture, which is left loose and drawn away from the site of the incision. This suture is for later approximation of the scleral section after the foreign body has been removed. The incision is now completed down to the choroid, or pars plana of the ciliary body,

great care having been exercised not to perforate or penetrate the uvea. By lateral traction on the scleral lips with the retraction sutures, this dissection is accomplished with reasonable care, and is continued until all of the scleral fibers overlying the uvea are completely cut through. We have found that as soon as a small black glistening uveal bead presents in the section the remainder of the uveal exposure can be facilitated by inserting the blunt tip of a pair of conjunctival scissors and dividing the few remaining scleral fibers with a single cut. The blunt back side of the lower blade of the scis-

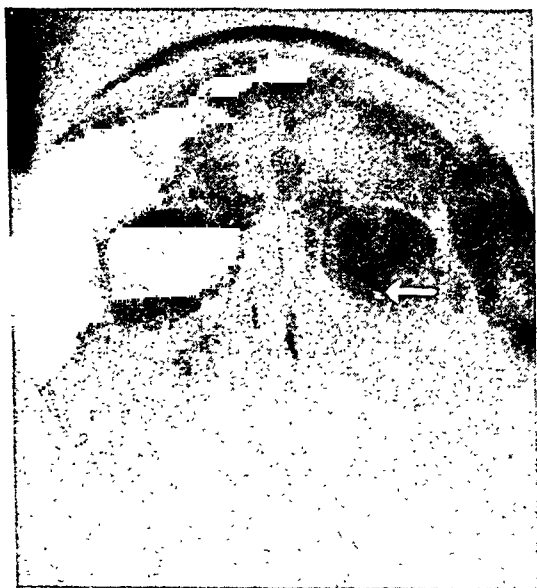


Fig. 4. (Struble and Croll). Posterior-anterior view, showing the metallic foreign body in the left eyeball.



Fig. 5 (Struble and Croll). The arrow indicates the lead marker and an error of 6 mm. in the lateral meridian.

procedure a black bead of choroid (or ciliary body, if the pars-plana route is being used) presents between the margins of the incision. When the approach is made posteriorly over the choroid, the scleral section should be made in the antero-posterior meridian. When the pars-plana approach over the ciliary body is utilized the section should be made from

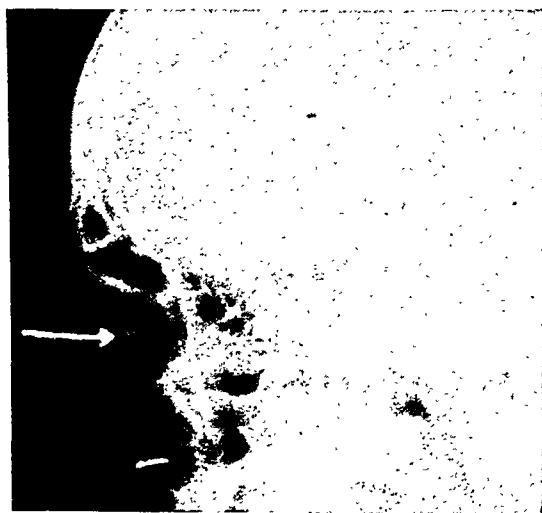


Fig. 6 (Struble and Croll). The arrow indicates the retained intraocular foreign body and the lead-plate marker. There is less than 1 mm. of error in the vertical measurement.

sors is used to push the uvea away from the scissors tips.

The section is now complete. Any bleeding encountered during this dissection is readily controlled by coagulation of the vessel with the diathermy tip, which should always be available both for the purpose of hemostasis and later for the diathermy barrage around the operative site, when indicated. At this step of the

6 to 8 mm. from the limbus, concentrically, and parallel with the ora serrata.

IV. REMOVAL OF THE INTRAOCULAR FOREIGN BODY WITHOUT PENETRATING THE CHOROID OR THE PARS PLANA OF THE CILIARY BODY WITH THE MAGNET TIP. The broad tip of the small hand magnet is placed in contact with the uvea. This particular tip was especially designed by Lancaster³ to give the strongest possible pull on a fragment at a distance. "The blunter and shorter the pole, the stronger the pull when tested at 20 mm. or more."

It has been found that the 6-mm. incision that has just been described is adequate, so that a considerable area of the magnet tip is in contact with the surface of the uvea. The foot switch is now closed and the foreign body drawn through the retina and choroid, or the pars plana of the ciliary body. This is possible because of the well-known fact that a metallic foreign body always approaches the magnet point first. It, therefore, acts as its own perforator and will emerge through the intervening tissues, making the smallest opening compatible with its size. In no event is it necessary to insert the magnet tip into the vitreous, even for extremely minute fragments. This is well demonstrated in the experimental work to be described. Particles over 0.5 mm. in size, if accurately localized, have sufficient impact cleanly to perforate the choroid and retina or pars plana, usually on the first application of the magnet. Foreign bodies 0.25 mm. in size will present beneath the uvea but usually require a small nick in the uvea for their delivery. We believe that there are many advantages in not entering the vitreous with the magnet. The risk of infection is reduced to a minimum, and intraocular hemorrhage with the resultant formation of vitreous bands and late retinal detachment is also reduced to a minimum or prevented entirely. We feel

we can safely explore or attempt the surgical removal of fragments which have some indication of being very poorly, if at all, magnetic, and that we can assure the patient in advance that should removal prove unsuccessful his eye will have in no way been injured. This is especially important should the eye be quiet, the vision normal or nearly so, and where the foreign body appears to be aluminum, plastic, or some other substance well tolerated by the eye.

V. CLOSURE OF THE SCLERAL INCISION. Following removal of the foreign body the mattress catgut suture, previously placed, is tied. This securely approximates the scleral margins. The silk retraction sutures on either side of the section are now removed or they may be tied together over the section as a supporting suture. They may temporarily be left uncut to act as a guide suture to be used in manipulating the globe during the last procedure; namely,

VI. THE DIATHERMY BARRAGE AROUND THE OPERATIVE SITE. Since the retina is in contact with the choroid, we have carried this barrage through only the outer two thirds of the sclera so as not to injure the underlying retina with the diathermy tip. If desired, surface scleral coagulation with the small ball electrode may be substituted, but care must be taken not to burn the sutures.

EXPERIMENTAL

FOREIGN BODIES FREE IN THE VITREOUS

In following these six steps, and using precise localizations with the lead-plate technique, it began to appear that almost all magnetic foreign bodies encountered in clinical work could be successfully removed with the small hand magnet alone. This included particles even as small as 0.25 mm. in diameter, provided the particle was within the "certain or critical zone" for its particular size. Obviously

a 0.25-mm. fragment, lying in the center of the vitreous 10 or 11 mm. away, cannot be reached with the hand magnet but may be reached with the giant magnet. We were, however, being confronted with an increasing number of foreign bodies free in the vitreous. It was felt that when possible, it was advantageous to remove these particles through the pars-plana approach instead of through a posterior sclerotomy over the choroid. This approach has the additional advantage that no penetration of the retina by the foreign body occurs, and for this reason any possibility of late detachment of the retina is reduced to a minimum. Immediately there arose the question as to what distances various-sized particles could be drawn through the vitreous and through the scleral incision.

The experimental work was performed with the use of particles of steel shavings measuring 1 mm., 0.5 mm. and 0.25 mm. in diameter, since these were the sizes most often encountered clinically. The work was carried out on eyes of freshly killed hogs, less than 12 hours dead, which were kept refrigerated until used. The small hand magnet with foot switch was used in all the experimental work for the reasons mentioned earlier in this paper. It is realized that many factors exist in these experiments not present in the injured human eye.

First the retina of the hog appears to be slightly thicker than that of man. Second, no organizing exudate, fibrin, or hemorrhage exists in the experimental specimens.

The vitreous in the fresh hog eyes grossly seemed to be of the same consistency as that of the human eye and was probably a negligible factor in error. Grossly, the choroid in the hog and human eye appeared to be almost identical in consistency and thickness.

The experiments were carried out as

follows: Scleral retraction sutures were placed as previously described about three sixteenths of an inch apart, and a scleral incision by layer dissection was made between the sutures down to the ciliary body or the choroid until the usual black bead presented. These sutures were then tied with one double tie so as effectively to close the incision temporarily during sectioning of the globe.

The eye was then turned on its side, and with a sharp cataract knife the entire anterior segment of the eyeball was cleanly and quickly excised on a plane just behind the iris. It was found that by utilizing a sharp knife and rapid section a negligible loss of vitreous occurred. The sectioned eye was again placed upright in the manikin, cut surface uppermost. The scleral silk sutures were untied, exposing the uveal bead as before.

The previously chosen, measured, and weighed metallic fragment was then inserted into the vitreous at varying distances from the scleral section, beginning on the side of the eye opposite the section. The blunt tip of the small hand magnet was applied in contact with the uveal bead and 10 consecutive tries for the foreign body were made; each consisted of five seconds' duration. In cases of failure the foreign body was removed from the vitreous and moved closer to the point of sclerotomy and another attempt at removal made. The distance in millimeters from the foreign body to the scleral section was carefully measured on each occasion prior to attempted removal. In each instance the foreign body was placed in the vitreous at a depth corresponding to that of the scleral section so that a straight pull with the magnet could be made on each occasion (figs 7-11).

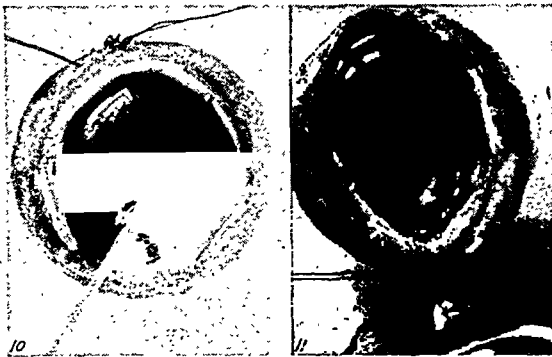
The direct observation of metal particles in the vitreous under magnetic attraction proved to be very interesting. The foreign body would move toward the



Figs. 7 and 8 (Struble and Croll). Experimental specimens. Fig. 7 shows scleral retraction sutures of No. 6-0 black silk in position. Fig. 8 shows scleral section completed. Black bead of choroid presenting.



Fig 9 (Struble and Croll). Experimental specimen. Removal of the anterior segment of the globe.



Figs. 10 and 11 (Struble and Croll). Experimental specimens. Fig. 10 shows the metallic foreign body being introduced into the vitreous. The reflexes represent high lights on the vitreous. Fig. 11 shows the foreign body emerging through the choroid. The magnet tip is held at a distance from the incision to demonstrate this to better advantage.

magnet to some degree, regardless of the distance involved. When the distance was too great for removal it would at once return to its original position when the foot switch of the magnet was released. In some instances, following 10 magnet applications, the final resting position of the foreign body would be a little closer than it was in the beginning, but in most cases it would come to rest in its original position. The experimental data accumulated in this work are tabulated in the three graphs (figs. 12-14). Each graph has been divided into three zones: first, a "certain zone" representing that distance at which the foreign body was always secured on the first attempt at removal; second, a "critical zone," where the fragment was secured following multiple applications; third, a "failure zone," representing that distance at which removal was impossible. The "certain" and "critical" zones for each sized particle were plotted on schematic eyes. These zones represent those distances at which particles of this size, free floating in the vitreous, can be consistently removed by the use of the pars-plana approach. The distances illustrated can likewise be applied to the posterior approach over the choroid. This route would be indicated in those cases wherein the given-sized fragment occupies a position far posterior in the vitreous. In such a case it may no longer fall within the "certain" or "critical zone" whence removal is possible by using a pars-plana approach.

On many occasions when the foreign body was under direct observation in the "critical zone" it was noted that it would at times appear almost to touch or "nudge" the retina during the application of the magnet and then return to its original position as the foot switch was released. With the foreign body in the "certain zone" it appeared that the success

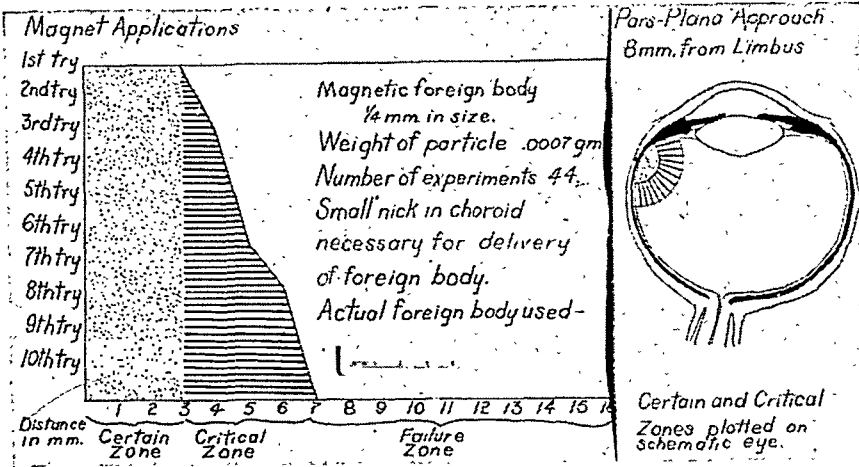


Fig. 12 (Struble and Croll). "Certain, critical, and failure zones" for magnetic fragment 0.25 mm. in size.

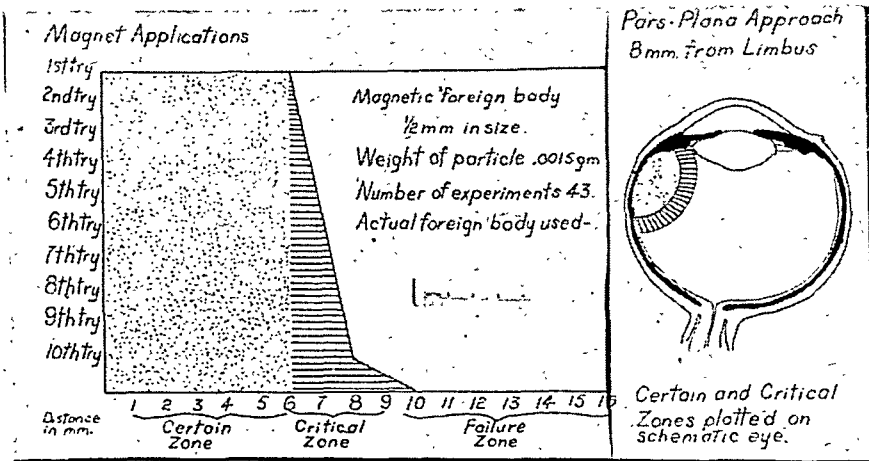


Fig. 13 (Struble and Croll). "Certain, critical, and failure zones" for magnetic fragment 0.5 mm. in size.

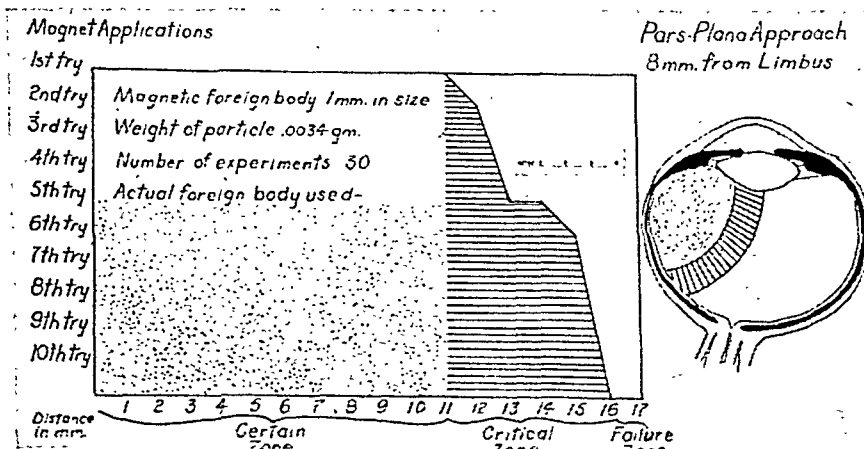


Fig. 14 (Struble and Croll). "Certain, critical, and failure zones" for magnetic fragment 1 mm. in size.

of the extraction on the first application of the magnet depended upon the initial impact of the foreign body against the retina and choroid and not upon any subsequent drag or pull on these membranes. This, we believe, is an important point, for the portal of exit of the fragments was very minute; so small, in fact, that it could not be seen afterward with the unaided eye and no late evidence of tension or traction on the uvea or retina could be made out. The 0.5- and 1-mm. fragment could always be delivered without difficulty. The 0.25-mm. fragments, apparently, as a result of their very small size and lack of impact, had to be aided in their path through the uvea by a very small nick with the tip of the cataract knife at the time they presented beneath these structures. In no instances were these fragments sharply pointed. They were, as a matter of fact, small square or oblong particles with blunt ends.

FOREIGN BODIES EMBEDDED IN THE RETINA AND CHOROID

In this series of experiments the hog eyes were prepared as before. The foreign body, however, instead of being planted free in the vitreous was now embedded in the choroid and retina at varying distances from the scleral section, and efforts at removal with the magnet were repeated in the usual manner. The series of experiments was inconclusive in so far as the ability to remove the foreign body at distances greater than 4 mm. was concerned. This was probably due to the fact that the fragment was not uniformly embedded in the choroid, retina, and the inner layer of the sclera in all instances.

One consistent fact stood out in this series. In those experiments where the fragment was pulled laterally for a distance of 3 or 4 mm. toward the sclerotomy opening and magnet, a tear or gutter of the retina or choroid was

created throughout the length of the movement of the particle.

In those cases, however, where the foreign body was embedded in the choroid or retina directly overlying the scleral opening, it was always pulled through by the magnet on the first attempt with a minimum of trauma to these layers. We feel this is another argument for precise pinpoint localization of metallic foreign bodies embedded in these structures at the time of surgical removal.

CLINICAL OBSERVATIONS

In the schematic eye represented below multiple metallic foreign bodies of indicated size are shown at the distances and in the zones in which their removal was accomplished. The diagram shows those

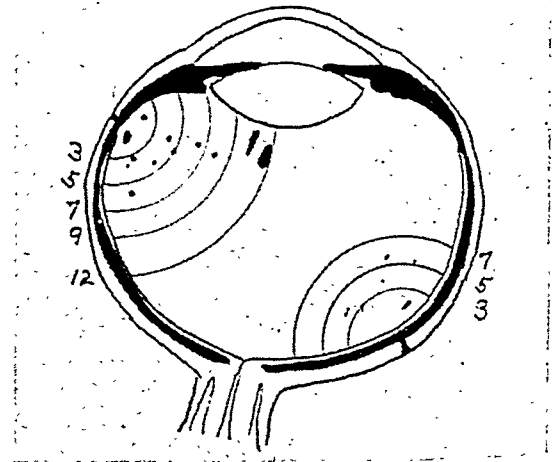


Fig. 15 (Struble and Croll). Schematic eye showing distances in millimeters in which metallic foreign bodies have been removed clinically. In no instance has the magnet tip penetrated the uvea.

foreign bodies removed over a three-months' period (fig. 15).

Those cases listed as pars-plana approaches and scleral sections over the choroid are grouped separately. These distances have been measured from lead-plate localizations made during the opera-

tive removal of the fragment. All of these particles were removed with the small hand magnet with a single exception. In this one instance a very minute metal fragment less than 0.25 mm. in size was localized and could be seen immediately behind the lens in the exact center of the globe. It was obviously outside the "certain or critical zones" for particles of its size. Repeated applications of the hand magnet produced no results. It was removed by a prolonged exposure (about three minutes) to the giant magnet.

In one case we misjudged the size of a fragment floating in the posterior vitreous and attempted to pull it forward through a pars-plana approach. The particle was so small it could not be visualized by the X-ray. We were unsuccessful both with the hand and the giant magnet. A posterior approach 10 mm. farther back over the choroid (and 10 mm. closer to the particle) resulted in prompt recovery of the fragment on the first application of the hand magnet. In every instance removal was accomplished without uveal penetration with the magnet tip. No instance of retinal separation, postoperative infection, or vitreous hemorrhage has occurred to date.

CONCLUSIONS

1. A method of pinpoint localization of metallic foreign bodies in the eyeball, using a small lead plate sewn to the sclera, has been presented.

2. The removal of magnetic foreign bodies in the posterior segment of the globe can be accomplished without penetrating the choroid or pars-plana with the magnet tip.

The success of this procedure depends on the following factors: (a). Pinpoint localization of the foreign body. (b). A painstaking layer dissection of the sclera between scleral retraction sutures until the black uveal bead presents in the section.

3. A simple method for fixation of the globe during the scleral section and removal of the foreign body has been described, together with a simple suture for closing the incision after the operation has been completed.

4. Retained intraocular magnetic foreign bodies down to and including particles 0.25 mm. in size can be consistently removed with the hand magnet, provided: (a) The foreign body has been accurately localized. (b) The fragment lies within the proper zone of action of the magnet.

5. Many cases of metallic foreign bodies free floating in the vitreous can be removed through a pars-plana approach providing the particles lie in the "certain" or "critical" zone as herein determined for its size and weight.

6. By referring to the tables and knowing the size of the magnetic foreign body in advance from the X-ray localization, the operator can choose with a considerable degree of assurance which operative approach will most likely give successful results.

Acknowledgement is made of the valuable assistance of Capt. Lewis N. Rudin (MC), and Technical Sergeant R. H. Wagner of the Photographic Laboratory, Crile General Hospital, and to Capt. Carl A. Hamann (MC), for the photographs in this report.

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THE OCULAR COMPLICATIONS OF LEPROSY*

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Traditionally, leprosy is dreaded as probably the most disfiguring of all diseases. It is also true, but not so generally recognized, that leprosy has a higher percentage of ocular involvement than any other systemic infection. When the threat of blindness is added to the patient's natural dread of the disease, the condition is indeed terrifying.

Tuberculosis, focal infection, syphilis, and other infections often involve the eye, but the ocular lesion of such infections is relatively limited as compared with that of leprosy, even if we accept the lowest statistics as given by the various authorities. The statistics of the percentage of eye involvement vary greatly in the reports of various leprologists. This variation is easily understood in view of the following conditions: (1) Variation of the forms of leprosy in different localities, the benign forms being prevalent in some places and the malignant in others; (2) difference of opinion as to what constitutes an ocular complication for statistical purposes, a mere conjunctival hyperemia being sufficient for one investigation while only well-defined, typical lesions are included by another; (3) available diagnostic procedures, an examination by an ophthalmologist with a slitlamp would reveal a much higher percentage of involvement than an observation by a general physician with a loupe; and (4) duration of the disease, it being obvious that the ocular involvement would be higher in the advanced cases.

In addition to these factors, there has always been difficulty in reconciling the data of various investigations because of a lack of a clear classification of the various types of leprosy. Different criteria have been used, and numerous classifications have been advanced, but none has proved entirely satisfactory. For years the *Bacillus leprae* (Hansen) has been accepted as the etiologic agent of leprosy, but the classification continues to be clinical and topographical. As late as 1931, at the Congress of Manila, the lesions were spoken of as a cutaneous type, which was very malignant with many bacilli, and a nervous type, which was relatively benign. Even at that time there was another well-recognized separate form, the tuberculoid type, that could not be placed in the foregoing classification. The Congress of Cairo (March, 1938) made an attempt to remedy this by accepting two primary types—the lepromatous and the nervous, with the tuberculoid as a subdivision of the latter. Although this classification is based on criteria partially histopathologic, in many ways it does not clearly define the nervous type.

Recently a number of South American leprologists set up a new classification in which there are three fundamental types: the lepromatous, the tuberculoid, and a third intermediate form called the non-characteristic for lack of a better name. The tuberculoid type is benign, with very few organisms, whose prognosis is generally good inasmuch as many lesions tend to regress spontaneously. The lepromatous type is malignant, with many bacilli, and tends to involve the entire system including the eyes. The non-characteristic form tends to evolve toward one or the other of the two former types;

* A condensation of the report presented at the Pan-American Congress of Ophthalmology in Cleveland, 1941. The original paper was illustrated with 51 figures.

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possibly being a type that will disappear when its characteristic features become better known. This classification is fundamentally histopathologic. It is difficult to use, but with experience may be applied to the great majority of cases. In doubtful instances, laboratory procedures will probably be sufficient to establish the exact diagnosis. With the use of this classification many inconsistencies disappear, particularly in the matter of prognosis and as to probabilities of ocular involvement.

I have had the opportunity to collect a series of 1,279 cases of leprosy classified on this basis. All of these cases have been under my own careful observation and have been examined with the slitlamp at least once a year, many of them oftener if the lesion were mild or progressive. This series tends to show not only the value of this classification but it also gives some definite figures as to the involvement of the various ocular tissues in the different types. Before the results of this study are given, a discussion of the common ocular lesions of leprosy should be presented to aid in a better and more complete understanding of these cases.

OCULAR LESIONS OF LEPROSY

EXTRAOCULAR INVOLVEMENT. The involvement of the skin of the brow and cheeks is very common in leprosy. The spread of these lesions into the eyelids is important to the ophthalmologists, for the lesions form an abundant source of organisms for direct invasion of the eye.

The lepromatous lesions have a predilection for the ciliary margin, more often than for the upper lid. They may be small and delimited or form large masses involving the entire ciliary portion of the lid. The tuberculoid lesions are common in the ocular region, often extending into the eyelids. This type of lesion, which is locally benign, may cause fixation of the

lids, at times, with some ectropion; it is the only effect on the eye of the tuberculoid type of leprosy that I have noted in this series of cases. Although rare, these cases show that contrary to the opinions of some authors this lesion has an effect on the globe, even though secondary. Of ophthalmic interest also is the erysipeloid reaction, in which there is a diffuse involvement of the lids resembling erysipelas. It is not important in that its course is benign.

Besides being a rich source of bacilli, the lid lesions are important in that they often affect the eye through the formation of a severe lagophthalmos. It is inevitable that in the healing of the lid lesions scarring would result, so that many of these lesions would result in a residual cicatricial lagophthalmos. In addition, a patient may show a paralytic type of lagophthalmos in which there is a peripheral lesion in the facial nerve, generally affecting the superior branch of the orbicularis. This may be found even in those cases wherein there are no local skin lesions. I have found that these facial-paralysis cases are quite infrequent, being especially found in hospitalized patients who have the terminal forms of leprosy. This infrequency is in contrast to the figures usually quoted in the literature, in which the incidence of facial paralysis is often over 50 percent. Many patients show a mixed type of lagophthalmos in which both the cicatricial and paralytic elements are present.

CONJUNCTIVA. The statement is usually made both in textbooks and in the literature that the conjunctiva is frequently attacked in leprosy. I believe that actual conjunctival involvement is very rare and that the commonly held idea is due to an error of interpretation.

A nodular infiltration of the tarsus and palpebral conjunctiva has often been described as occurring frequently, but such a lesion was not noted in my series. When

seen, they are probably due to secondary invasion from the lids or from the deeper tissues. In two of my cases no leprosy lesions could be noted in the lids clinically, but after intravenous administration of methylene blue, stained areas were noted in the tissues. Bacilli were proved to be present in these areas.

Isolated lesions in the bulbar conjunctiva have also been described as of frequent occurrence, particularly around the limbus. I think that such lesions in reality originate in the episclera and involve the conjunctiva secondarily. I have never seen a lesion of the bulbar conjunctiva that was confirmed by histologic examination.

There is no evidence that there is any such entity as a leprosy conjunctivitis. However, acid-fast bacilli are often found in the conjunctival cul-de-sacs in the absence of any lesion in the lids and with a negative nasal mucous membrane. In biopsy specimens from the bulbar conjunctiva in clinically normal cases, no bacillic lesions were seen deep in the stroma, even around the nerve trunks.

Invasion of pterygia by leprosy has also been frequently noted in the literature. Many pterygia were removed in this series of cases, but in none was there any histologic evidence of involvement with leprosy.

EPISCLERA AND SCLERA. Because of its extremely rich blood supply and looseness of tissue, the episclera presents an ideal site for the localization of leprosy lesions. These are of two general types: diffuse episcleritis and a localized or nodular episcleritis or scleritis.

The diffuse type is generally an acute process, presenting itself as a diffuse purplish discoloration typical of lesions situated below the conjunctiva. It is usually quite extensive, but generally of a very transient nature. This is so characteristic that I was never able to make a histologic examination.

The localized type at times occurs very suddenly as an acute nodule, sometime quite slowly as a true chronic lesion. It is usually near the limbus, but may occur well out in the bulbar conjunctiva. It is very often symmetrically placed in the two eyes. It almost always originally arises in the temporal portion. Although occasionally seen superiorly and inferiorly, I have never seen it arise nasally.

In the chronic cases it is first noted as a small, slightly elevated gelatinous nodule, dirty-yellow in color. As it causes no discomfort, it may remain unnoticed by the patient for years. It may then assume an acute character and within a few days become quite large. In other cases the course from the first is acute. In two or three days a large nodule may form from an apparently normal conjunctiva. These cases are almost constantly limbal in nature. There is usually some indefinite ocular discomfort in the acute type.

The episcleral lesion usually progresses toward the limbus, around which it may then tend to grow, giving an appearance suggestive of the limbal hypertrophy of vernal catarrh. However, I have never seen it completely surround the limbus. Once having reached that point, the lesion is progressive, with invasion of the cornea, which will be discussed later.

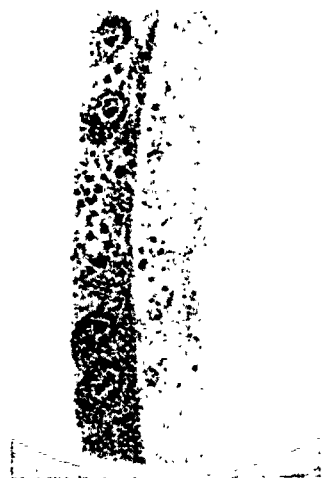
Bacilli are always found abundantly in these lesions. The ultimate histologic evolution is in the direction of a localized sclero-corneal leproma. This supports the conclusion that this lesion is a specific infiltration, probably metastatic.

CORNEA. The incidence of keratitis in leprosy is extremely high, primary involvement having been seen by me exclusively in the lepromatous type. Both eyes are usually affected; there is seldom an advanced lesion in one eye with the fellow relatively free. In time there is a more or less perfect similarity between the two corneas.

In primary leprous involvement of the corneas there are two types, an interstitial or infiltrative keratitis and a nodular keratitis or corneal leproma. These two types have, in general, a similar histologic background, since both of them usually arise by invasion of the cornea from episcleral lesions. They differ chiefly in clinical characteristics, the former being diffuse, the opacity extending in time throughout almost the whole extent of the cornea, with little change in thickness or luster. The latter consists of a localized module with an enormous, up to tenfold, thickening of the cornea. Both types are

first noted in the superior temporal quadrant (fig. 1), starting as a number of small white dots in the anterior third of the corneal stroma which coalesce to form a small area of deep infiltration (fig. 2).

Fig. 2 (Mendonça de Barros). Corneal infiltration under high magnification (Oc. orthosk. 12.5, Obj. 6, lens of 7 cms. focus). A number of small nodules which serve as the center of a delicate zone of infiltration. There is a true punctate indentation of the cornea.



This extends nasally and inferiorly so that the inferior nasal quadrant almost always retains its transparency the longest. In only one case was involvement of the inferior nasal quadrant originally noted.

In all cases the infiltration was chiefly in the central third of the stroma. In most instances there were areas of denser infiltration resembling tiny scattered nodules scattered throughout the opacity. In some cases the infiltration remained uniform, extending throughout the whole thickness of cornea. Again, the nodules were quite superficial, causing a surface elevation. In a few cases, the infiltration was both superficial and very deep, leaving the intermediate layer almost uninvolved.

The extraordinary predilection which the infiltrative foci have for the corneal nerves is extremely interesting (fig. 3). These nerves are usually easy to see, often showing not only well-defined nodular formations attached like beads, but also a diffuse, surrounding infiltration. Eventually fusion of the foci occurs.

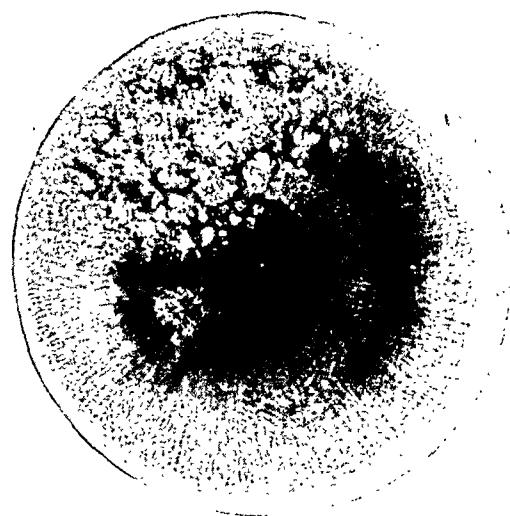


Fig. 1 (Mendonça de Barros). Infiltrative keratitis ("Sclerotic scatter." Microscope with Oc-2, Obj. 2—5.5 by 2X, right eye). The infiltration is most marked in the superior temporal quadrant, and consists of numerous rounded and well-defined foci, which occupy the anterior layers of the stroma. No vessels are seen. This case is shown by direct slit-illumination in figure 2. This type is called "superficial punctate keratitis of leprosy."

surprisingly symptom free. There is usually no ciliary infection, pain, or photophobia, and the visual acuity remains good for a comparatively long period.

In a manner surprisingly uniform, infiltrative keratitis practically always was

Vascularization is not an early finding and is usually present only late in the course of a keratitis. The vessels appear only after the keratitis has attained a large size. The vessels are usually both superficial and deep. Erosions are rare in this form of keratitis and are usually associated with an edema of the epithelium.

The course of this type of keratitis is practically always progressive, the infil-

appears in those patients who are victims of a massive infection in contrast to the infiltrative form, which is often seen in patients with a minimal infection.

As a rule leproma of the cornea represents invasion of the cornea from an episcleral lesion which is usually seen near the temporal limbus. In the region of the episcleritis there is first noted a slightly yellowish infiltration of the deep stroma with early vascularization. Usually, this lesion slowly develops into a localized nodule, but the nodule formation may take place very rapidly. Occasionally the nodule may form from the diffuse infiltrative type of keratitis by coalescence of the small infiltrates. These nodules have a typical dirty-yellow color resulting from a large number of Virchow cells full of fat. These lepromata are generally bilateral and often symmetrical. The vascularization is usually very marked. The lesion is frequently so indolent that it is practically symptomless except for the irritation that may arise from its size. It is very hard and often undergoes central necrosis. As the nodule spreads throughout the cornea, the progressive necrosis causes a weakening of the corneal stroma with a resulting staphyloma and eventual loss of the globe.

Besides these two forms of primary corneal involvement, there are a number of cases of keratitis which are secondary to other lesions. A small number of cases of ulcerative keratitis were found present in both cicatricial and paralytic lagophthalmos. This is about the only type of leprotic keratitis in which there is true corneal ulceration. Keratitis secondary to iridocyclitis is due to the toxic action of the massive anterior-chamber exudates. These coming in contact with the posterior surface of the cornea cause an invasion of the corneal stroma with vascularization, which often tends to be ring-shaped near the limbus. Rarely are cases of bulbous

Fig. 3 (Mendonça de Barros). Perineural infiltration of the cornea (patient Atilio C., mic. with Oc. 4, Obj. 2, employing the direct method and focusing upon the center of the nerve bundle toward the periphery of the cornea). Note the sleeve-like formation around the nerve as well as several well-defined nodules.

tration eventually spreading throughout the entire extent of the cornea. In only a few cases did this infiltration localize in the upper temporal quadrant, become vascularized, and remain unchanged for years. Usually a diffuse leucoma develops with flattening and shrinking of the cornea. There is usually no clearing of the corneal opacity although in a few cases this has occurred. In my opinion it is due to a hyalinization of corneal scar.

I have presented previously a series of 62 cases showing that in the great majority of the cases bacilli were present. The localization of the infiltration in the anterior third is probably due to the fact that the spread is from the episclera and along the corneal nerves.

Nodular keratitis differs from the previous form by the development of a discrete inflammatory mass. This lesion often

keratitis seen in cases of long-standing keratitis with degeneration.

IRIS. Although less frequently attacked than the cornea, iris involvement is very common. However, I have never seen any case in which the iris lesion was noted without previous involvement of the cornea. The cases of iritis as seen by me may be divided into a diffuse lesion with acute and chronic forms and the miliary lesion in nodular iritis.

Acute diffuse iritis of leprosy presents little or nothing typical of the disease. It is usually an acute exacerbation of a pre-existing chronic iritis, and after one or more acute attacks reverts to a chronic type. The onset is usually abrupt, with intense pain and photophobia, blurring of vision, and blepharospasm. Although binocular involvement is almost the rule, the acute attack is not usually simultaneous. The attack often follows cauterization of a limbal episcleral nodule. On examination, ciliary infection is not commonly observed, but corneal edema, keratic precipitates, and anterior-chamber exudates are the rule. These gelatinous masses are usually composed of fiberlike filaments which branch, often forming a diffuse web, and tend to develop on the anterior surface of the iris. The attack is of variable duration, but is usually in direct relation to the general condition of the patient. In favorable cases the symptoms may disappear in two to three weeks, but many cases become chronic. Frequent recurrences are very common. It is worth noting that this is the only acute form of ocular leprosy. A peculiarity often noted is a resistance to dilation with atropine.

In the chronic type there is almost complete absence of inflammatory symptoms, the only complaint being slight blurring of vision. There are usually some corneal edema, faint aqueous flare, fine deposits in the endothelium. Often exudates in the anterior chamber, such as are observed in

the acute form, are seen. Also, as in the acute form, eventual bilateral involvement is the rule.

As in any iritis, both the acute and chronic forms show eventual posterior synechiae, iris atrophy, and organization of the anterior-chamber exudates. As noted previously, these exudates often form a ring-shaped band at the base of the iris with secondary keratitis. If marked, this type also commonly is associated with secondary glaucoma.

The miliary or nodular type of iritis is characterized by the presence in the iris stroma of small translucent nodules seen only with the aid of the slitlamp (figs. 4 and 5). Very often any other inflammatory sign is completely absent and the vision normal. This reaction may be present for years without great damage to the eye. The nodules are most often seen in the region of the sphincter, where they may form a complete collar. They may disappear to be replaced by a new formation of nodules. There may be coalescence of some few nodules, but a very large conglomerate nodule is never seen. A pseudo nodule may appear after the diffuse form. This consists of a tiny bit of the commonly seen anterior-chamber exudate. It is noted that these are situated on the surface of, and not in, the stroma.

AFFECTION OF THE POSTERIOR SEGMENT. Although there is no satisfactory explanation for it, leprologists, almost unanimously agree that the posterior segment of the eye is spared almost without exception. Personally I have never seen a case of proved posterior-segment involvement.

RESULTS OF OBSERVATIONS

As stated previously, I have personally observed 1,279 cases of leprosy, each being carefully examined with the slitlamp at least once a year, oftener if the case is early or progressive. The high percentage

of involvement observed by me is due to the slitlamp examination, for without it this incidence would probably be no higher than 30 to 40 percent. At the time of the last examinations, the 1,279 patients were

of the episclera alone is difficult to diagnose, owing to its small size and the fact that it is deeply placed. This small percentage does not invalidate my contention that the episcleral involvement usually

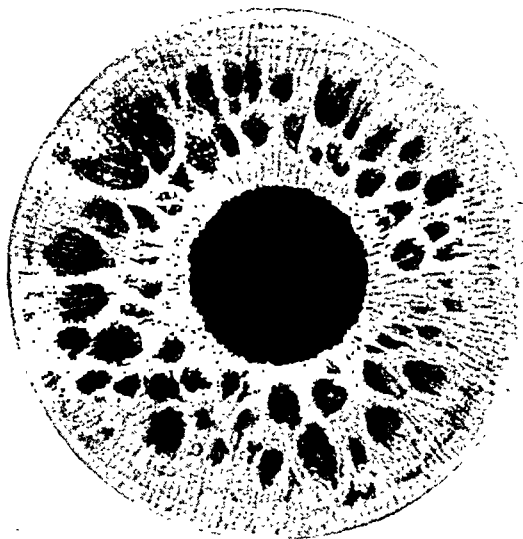


Fig. 4 (Mendonça de Barros). Miliary nodules in the iris (right eye, patient P. G., Oc. 2, Obj. 2, diffuse illumination). Myriads of miliary nodules are found in the iris, especially temporally, filling the crypts; others are seen in the depths of the mesodermal layer. The pupil is round. There is no exudation into the aqueous humor.



Fig. 5 (Mendonça de Barros). Nodular cauliflower formations (Oc. 12.5, Obj. 6, diffuse illumination, left eye). There are sharply rounded deposits on the cornea; marked atrophy of the iris tissue. In this case, the formations were observed after intense exacerbations of acute diffuse iritis.

classified from their systemic findings as follows:

Type	No. of Cases	Percentage
Lepromatous	826	64.7
Tuberculoid	261	20.4
Noncharacteristic	190	14.9

In the lepromatous type there was ocular involvement in 540 cases of the 826 or about 65.3 percent. In each of these 540 cases there was involvement of the cornea; in other words, no case in which the eye was involved was without corneal lesion. Clinically, I could verify the presence of an episcleral lesion in only 8.5 percent of those with ocular disease, or only 5.6 percent of the lepromatous group. This number is small, for the early involvement

precedes the corneal lesion, for many of these episcleral nodules are almost microscopic. The iris was attacked in 180 cases—24.5 percent of the lepromatous group and 35.1 percent of those with ocular involvement. Of these, 139 were of the diffuse type, acute or subacute. Miliary nodules were noted in 69 patients. In 33 cases the routine examination showed signs of an old, healed iritis. Of these, 16 patients had a subsequent acute attack.

In the tuberculoid type there were only 4 cases of ocular disease in the total number of 261. In two of these cases there were lesions of the buccal region, and first a paralytic, later a cicatricial lagophthalmos with exposure keratitis. The third was a case of typical facial paralysis with

marked ectropion and lagophthalmos. The fourth case presented an extensive facial lesion, with resultant ectropion and involvement of lid margin of the opposite side. Thus in these cases there was no direct ocular involvement.

Noncharacteristic leprosy was present in a total of 196 patients, a great majority of whom were children. In 19, or about 10 percent, the examination was positive, all of them showing corneal lesions. In 17 cases the findings were doubtful. In the positive cases, the ocular lesions suggested that the leprosy was of the malignant form, even though the general type was noncharacteristic. The course of these cases will be carefully observed to determine whether the ophthalmic examination is of value prognostically in the nonchar-

acteristic type of leprosy.

In conclusion it can be stressed that the ocular complications of leprosy are restricted to the anterior segment, the cornea being usually involved. Iritis is also common, but found only in conjunction with corneal disease. The keratitis is thought to be due to extension from limbal episcleral lesions. The primary ocular lesions are practically limited to the lepromatous or malignant type of general disease in which many bacilli are present. The ocular lesions are only secondary to facial involvement in the benign tuberculoid form. In the noncharacteristic form, common in children, the ocular findings may be of prognostic significance.

Rua Marconi, 34-4º.

DISCUSSION

DR. PETER C. KRONFELD (Chicago): Dr. Mendonça de Barros is no stranger to the United States of America. He is the author of the monograph "Some clinical aspects of the ocular involvement in lepers," which was published under the auspices of the Department for the Prophylaxis of Leprosy of the State of Brazil one year ago. This monograph, though written in the Portuguese language, also contains a slightly condensed translation into English which together with the excellent illustrations has put the author and the sanatorium "Padre Bento," where all the work was done, on the map for the North American readers. Today Dr. Mendonça de Barros has probably presented here as vivid and comprehensive a picture of leprosy of the anterior segment of the eye as has ever been presented at an ophthalmologic meeting. Having been asked to open the discussion, I believe it would be a mistake if I tried to add to this picture by reporting some of my personal experiences

with regard to ocular leprosy. It is true that I have had the opportunity to examine a large number of patients with ocular leprosy. These were inmates of various leprosaria in the Far East, in China, in Japan, and in the Philippines. In most instances, however, I saw these patients only once and had only a loupe and a flashlight at my disposal. At the Peking Union Medical College, with which I was associated from 1933 till 1939, I saw only very few lepers, who usually were admitted for the treatment of conditions other than their leprosy. The ocular manifestations of leprosy which I saw in these patients were, in general, on the same order as those shown and discussed here today by Dr. Mendonça.

I believe that as the first discussant it is my duty to recognize the special opportunity constituted in Dr. Mendonça's presence here. And I hope he will not mind my asking him questions pertaining to problems of leprosy which have not been mentioned in his paper. Physicians prac-

ting in the Far East are placing considerable stock in the so-called climatic theory, which was lately expressed again in a study by Shionuma Einosuke (Lepro, Osaka, 1939, v. 8, p. 57). According to this author the severity of the ocular symptoms depends to some extent upon the climate. The higher the temperature the milder are the ocular symptoms and vice versa. In general, leprosy is supposed to be a milder disease in the tropics than in a moderate climate. The Japanese author has recommended to the government that leprosaria should be located only in the southern parts of Japan. Viallefont and Fuentes have expressed a similar view (Ann. d'Ocul., 1939, v. 175, p. 380). I would like to get Dr. Mendonça's opinion with regard to this question.

We have been following with a great deal of interest the controversy that has been going on in the Brazilian ophthalmologic literature with regard to the question of early choroidal involvement in leprosy. The viewpoint of the pathologist

who sees more late than early stages of the disease (Ginsberg in Henke-Lubarsch's "Special pathology") is that the retroequatorial portion of the uvea is usually spared. Most clinicians have agreed with this view. It was therefore surprising when Hoffman reported early clinical choroidal involvement. The recent paper by Sergio Valle (Arqu. braz. Oft. 1938, v. 1, p. 31) seems to take a very sensible stand in the matter. Valle admits that the course and the manifestations of leprosy may vary in different countries. He observed choroiditis in a number of lepers, which, he believes, was probably caused by tuberculosis or lues. He summarizes that the leprous etiology of choroiditis has not been proved anatomically or clinically.

While a very remote subject for most North American ophthalmologists, this discussion of a disease that affects in considerable number in a neighboring country I am sure has been of great interest and value.

CONCENTRATION OF PENICILLIN IN THE AQUEOUS HUMOR FOLLOWING SYSTEMIC ADMINISTRATION*

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Penicillin has been used for infections of the eye with varying degrees of success. Some types of infection, such as gonorrheal ophthalmia, have been shown to respond readily to this therapeutic agent whereas the intraocular infections respond with difficulty, if at all. To determine what might be expected from systemic therapy an investigation of the concentration of penicillin in the aqueous humor in relation to blood levels was undertaken.

Von Sallmann and Meyer¹ had previously shown that local application, with iontophoresis, as well as intravenous injection of penicillin resulted in a demonstrable concentration of the agent in the aqueous humor. A careful study by Struble and Bellows² revealed the distribution of the agent in various structures of the eye following parenteral and topical application.

No reference to the effect of varying systemic dosages on concentration of penicillin in the eye was found. In a report on the clinical efficacy of the drug in ophthalmic diseases, Keyes³ indicates that little is known about the secretion of penicillin into the secondary aqueous in the presence of a high blood concentration. He also points out that the rapidity with which the level of penicillin in the aqueous is reduced by normal drainage has not been ascertained.

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The opinions and views set forth in this article are those of the writers and are not to be considered as reflecting the policies of the Navy Department. A thesis presented to the American Ophthalmological Society in partial fulfillment of the requirement for membership.

EXPERIMENTAL PROCEDURE AND RESULTS

Rabbits were chosen as the experimental animal, subsequently monkeys for a series of confirmatory experiments. Commercial preparations of the sodium and calcium salts of penicillin were administered by the intravenous or intramuscular route.

The concentration of penicillin in blood serum was determined for correlation with that found in the aqueous humor. For this, samples of blood were withdrawn by cardiac puncture or from an artery in the ear at intervals of 5, or, in some instances, 10 minutes prior to collection of aqueous humor.

Employing a fine hypodermic needle and a syringe, paracentesis of the cornea was performed for withdrawal of approximately 0.2 ml. of aqueous humor. Secondary or plasmoid aqueous was collected 40 minutes after withdrawal of the primary fluid, at which time it had re-formed in sufficient quantity to bring the tension in the anterior chamber to normal.

The Rammelkamp⁴ method of assay was employed. This is a serial-dilution method, using the hemolytic streptococcus as test organism. Relative Oxford units are calculated by comparison with an assay done concurrently on a standard solution. Under conditions of the test, a concentration of 0.0195 units of penicillin per milliliter of the test solution was required for complete inhibition of the organism.

The animals were tested in experimental groups of four or five. In the early studies one animal in each group

served as a control, receiving no penicillin. At no time was an inhibitory effect demonstrated with the blood serum or aqueous humor of these control animals against the streptococcus used in the penicillin assay.

Individual animals showed a marked variation in the concentration of penicillin found in the blood and aqueous humor following intravenous injection. In a total of 16 rabbits, weighing between 2.4 and 3.4 kilograms, four served as controls and

approached or equaled that in the blood serum collected 10 minutes earlier, and the values for the 12 animals were from 0.0781 to 2.5 units per milliliter of fluid.

Following intramuscular injection there was found to be less variation for the individual animals than after intravenous injection. The concentration of penicillin found in the blood serum and aqueous humor of 35 rabbits receiving the therapeutic agent by intramuscular route in varying dosage is shown in figures 1 and

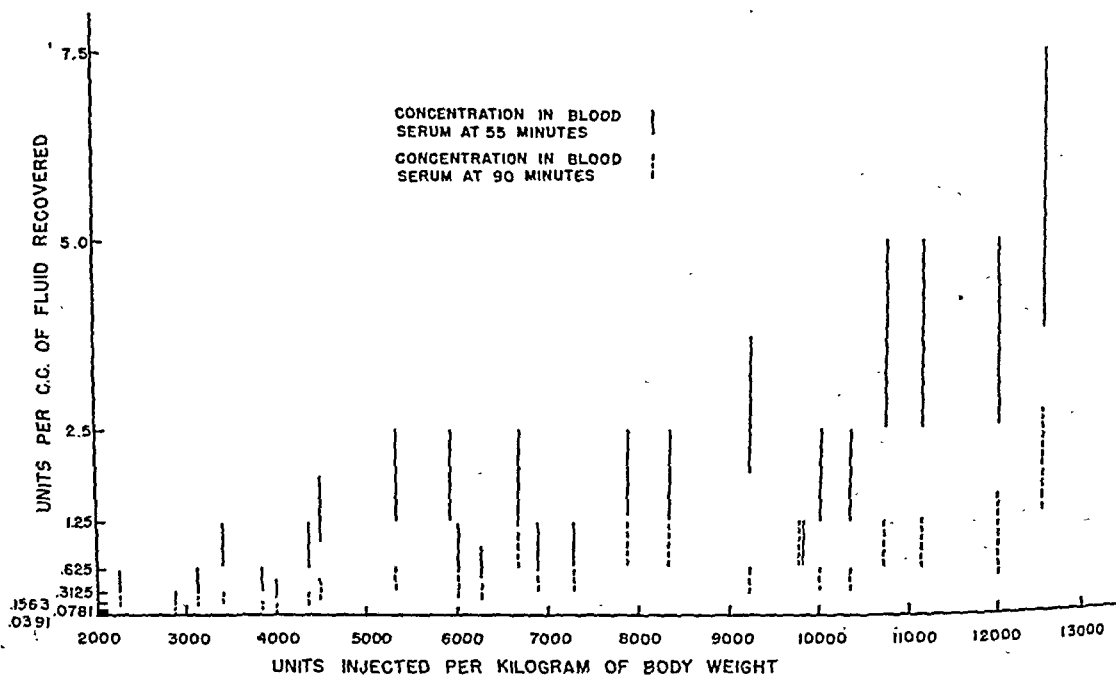


Fig. 1 (Town and Hunt). Penicillin levels in blood of rabbits following intramuscular injection.

each of the remaining 12 received 30,000 units of penicillin. Blood samples withdrawn at 25 minutes from these 12 test animals yielded from 0.625 to 10 units per milliliter of serum and samples at 60 minutes varied from 0.0781 to 2.5 units per milliliter of serum. Concentrations of 0.0195 to 0.1563 units per milliliter were found in the primary aqueous humor withdrawn at 30 minutes. In each instance the concentration in the secondary aqueous humor withdrawn 70 minutes after the intravenous injection of penicillin

2. In the serial-dilution method of assay used, the result is based on the highest dilution giving complete inhibition of the test organism. Since each successive dilution results in a concentration one half that of the preceding sample, the true endpoint of inhibition lies in the range between the dilution giving complete inhibition and the next higher one. In these figures, that range is indicated by a bar at each point on the abscissa. Penicillin was found in demonstrable quantity in each sample tested.

The concentration of penicillin in the blood of the 35 animals receiving intramuscular injection, was found to increase as the dosage level was raised (fig. 1). The curve of blood concentration rises gradually as the dose is increased to 5,000 units per kilogram of body weight. At that point the curve levels off until a dosage of 9,000 units per kilogram is reached, when it again climbs sharply. It may be that the ability of the kidney to excrete penicillin is not exceeded by this

ing dosage, the rise in concentration in the aqueous was proportional, but a high level was never obtained. The concentration was, however, sufficient to be considered of therapeutic value with all doses above 7,000 units per kilogram of body weight. Following paracentesis, the aqueous fluid re-formed within 40 minutes with a concentration of penicillin which approached or equaled that of the blood serum. It is well known that this secondary aqueous humor contains many

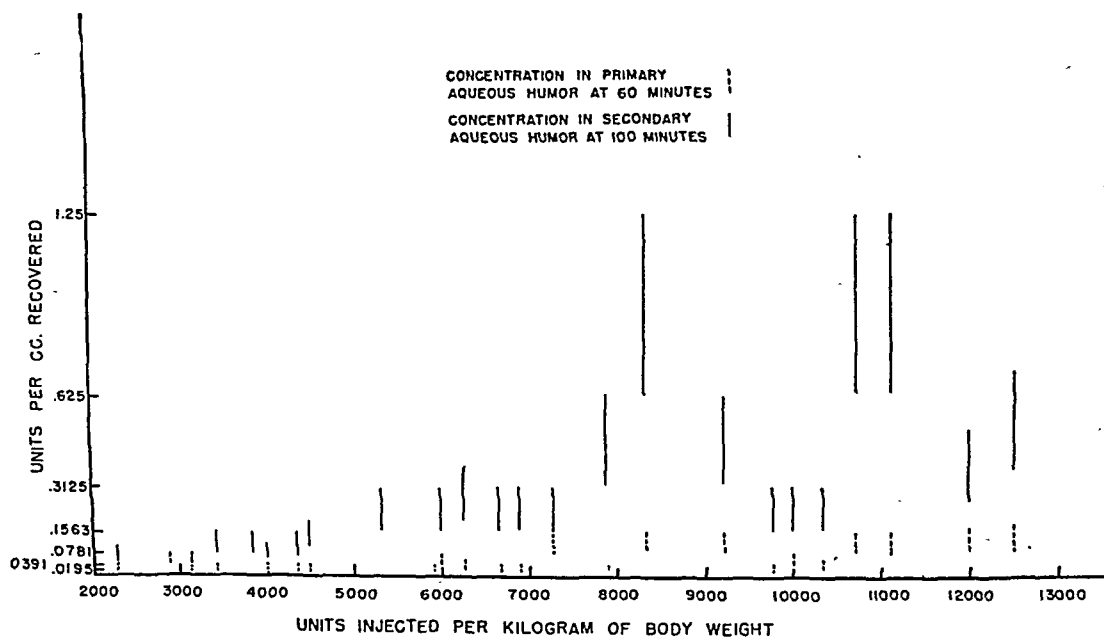


Fig. 2 (Town and Hunt). Penicillin levels of aqueous humor of rabbits following intramuscular injection.

intermediate dosage of 5,000 to 9,000 units per kilogram of body weight. Larger dosage may then result in a sharp rise of blood concentration, when the absorption rate exceeds the excretory rate.

The primary and secondary aqueous humor of these same 35 animals was withdrawn following the collection of blood samples to determine the corresponding penicillin concentration in the aqueous at the varying dosage levels (fig. 2). In the primary aqueous humor of animals receiving small doses, the penicillin levels were found to be low. With increas-

ing dosage, the rise in concentration in the aqueous was proportional, but a high level was never obtained. The concentration was, however, sufficient to be considered of therapeutic value with all doses above 7,000 units per kilogram of body weight. Following paracentesis, the aqueous fluid re-formed within 40 minutes with a concentration of penicillin which approached or equaled that of the blood serum. It is well known that this secondary aqueous humor contains many

The rate of loss of penicillin from the blood and aqueous humor of rabbits was studied following intravenous and intramuscular injections. Blood levels fell rapidly after injection by the intravenous route, as is indicated by the finding that 80 minutes after injection of 30,000 units in a rabbit weighing 2.8 kilograms, penicillin was present in a concentration of only 0.0391 units per milliliter of serum. In the primary aqueous fluid the level

muscular injection. Following paracentesis in the presence of a high blood level, the concentration in the aqueous rose sharply. Experimental results showed that the rate of decrease of penicillin in this secondary aqueous followed, in general, the curve of decrease in the blood. Although the concentration did not reach the high levels found in early blood samples, it was resorbed more slowly.

In one group of rabbits each animal,

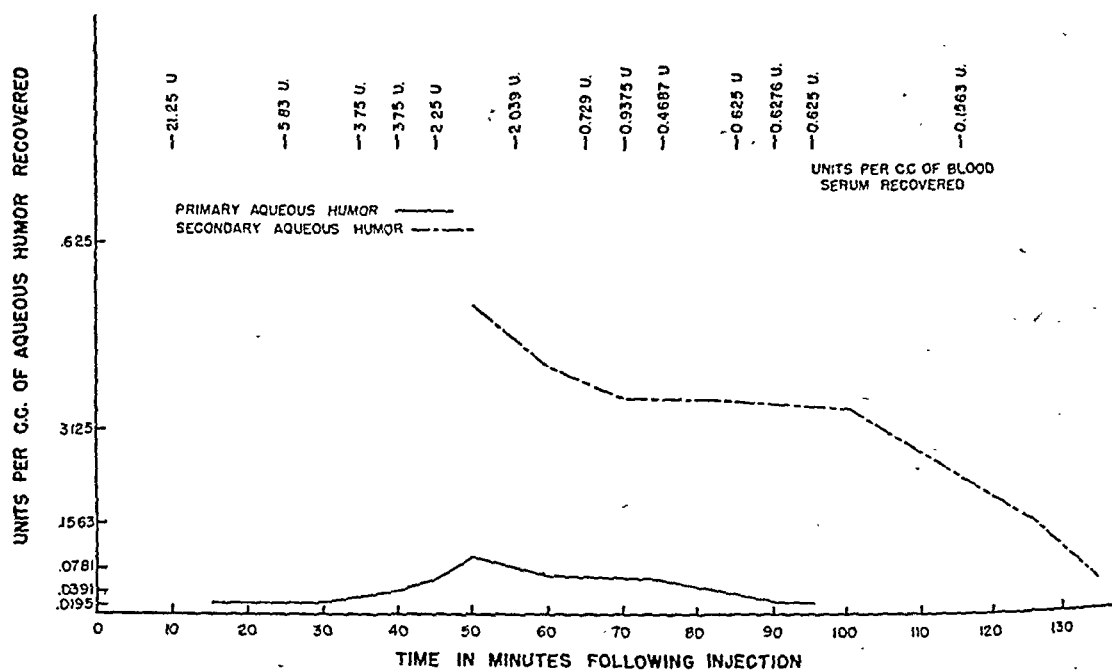


Fig. 3 (Town and Hunt). Penicillin levels in aqueous humor and blood of rabbits following intramuscular injection of 30,000 units.

reached a slight elevation at 45 minutes, after which time it descended in a definite but gradual curve.

With intramuscular injection the decrease of concentration in the blood was somewhat more gradual than with intravenous injection, although it was still rapid, as will be seen in figure 3. The peak of concentration in primary aqueous fluid occurred at 50 minutes following injection by this route. Although the level was never high, it would appear to be of therapeutic significance that this low level was maintained fairly constantly for over 90 minutes following a single intra-

weighing approximately two kilograms, received 15,000 units every three hours over a period of 24 hours. Assays of blood serum and aqueous humor showed no cumulative increase in concentration of the penicillin.

Results obtained with monkeys were comparable in all instances to those obtained with rabbits. The relative concentration of penicillin in the blood serum and aqueous humor was similar and all findings confirmed those in the rabbit.

CONCLUSIONS

The foregoing findings show that, fol-

Following systemic administration, penicillin is present in the aqueous humor in concentrations that are low in relation to blood levels. Massive doses of the therapeutic agent are required for an appreciable increase in this level. Penetration into the aqueous humor appears to occur slowly, and the decrease in concentration

is gradual. Continued, frequent injections maintain a low level without increment. Following paracentesis the aqueous humor is re-formed within 40 minutes with a concentration of penicillin approximating that of the blood serum.

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FASCIA-LATA TRANSPLANT FOR RETROTARSAL ATROPHY OF UPPER LID FOLLOWING ENUCLEATION

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About 30 percent of all patients who have had an enucleation develop a sinking of the orbital contents posterior to the septum orbitale in the upper lid. Attempts have been made by artificial eye makers to overcome this condition by enlarging the upper part of the prosthesis with a bulge to press the upper-lid fold

ward on the levator and interfere with the action of this muscle. Since it is really the restoration of the normal lid fold that is desired and not the filling-in of the orbital contents, it was decided to place fascia between the septum and the orbicularis. If the lid fold on the normal side is examined, it will be observed that it is only necessary to add bulk and weight in the lid immediately below the brow line to restore this fold. In this region the greatest space is available between the skin of the lid and the septum orbitale (fig. 1) and also between the orbicularis and the levator. If the fascia is placed lower than this, pressure is exerted on the levator and a partial ptosis results. One further precaution is necessary. The fascia must be placed beneath the orbicularis, otherwise it will adhere to the skin, and the result is induration and scar-tissue formation.

Up to the present time 134 patients have been operated upon by various members of the staff at this hospital.

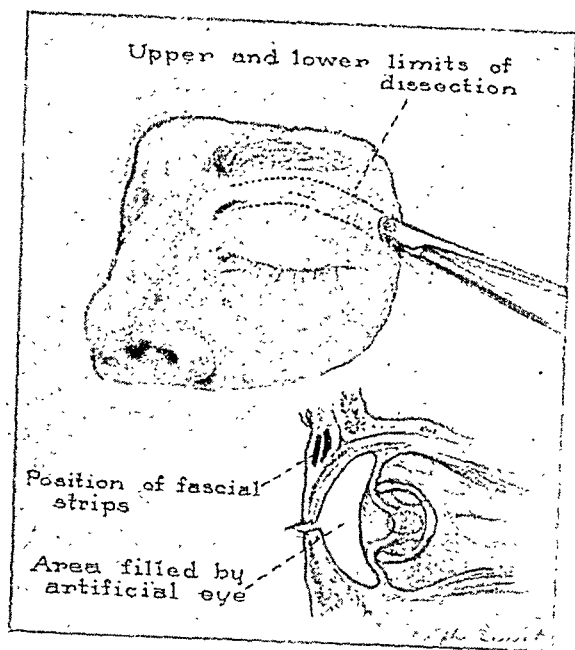


Fig. 1 (Cutler). Dissection and scheme to show insertion of fascia lata.

forward. The results have not been too gratifying since this procedure limits the movement of the prosthesis.

According to Spaeth¹ fascia and fat and scales of cartilage have been used to fill in this defect. Plastic material has also been used.² The recent literature discloses no satisfactory study of this problem.

Any material placed behind the septum orbitale has a tendency to disappear into the orbit and may exert pressure down-

OPERATIVE PROCEDURE

Anesthesia. Three different methods of anesthesia were tried: General (either inhalation or pentothal sodium); combination of spinal and local; and local. The last-named method was found to be the most satisfactory.

Obtaining the fascia. Only fresh fascia lata obtained from the patient himself has been used up to this time. This is procured from the lateral aspect of the thigh. Any standard procedure may be used.

The lateral aspect of the thigh down to the fascia lata over an area measuring 12 by 30 cm., beginning about 5 cm.

below the trochanter is infiltrated with 1-percent procaine containing 1:50,000 adrenalin. A skin incision about 5 cm. long is made lengthwise, beginning about 5 cm. below the trochanter. This is carried down through fat to the fascia. The latter is exposed for the length of the incision. Parallel incisions are then made lengthwise through the fascia 10 to 12 mm. apart; the upper end is cut across and carried through a Masson stripper, and while this end is held with a clamp, the stripper is passed down the leg to the desired length (about 15 cm.) and the fascia cut by rotating the handle of the stripper. The fascia is then removed. Difficulty may be encountered with transverse fibers near the upper end of the fascia; these can be cut with a needle guide which has the notch sharpened. The incision is closed with 00 chromic catgut sutures and interrupted silk sutures for the skin. No disfiguring scar remains.

This fascia is then placed in normal saline until the lid has been made ready

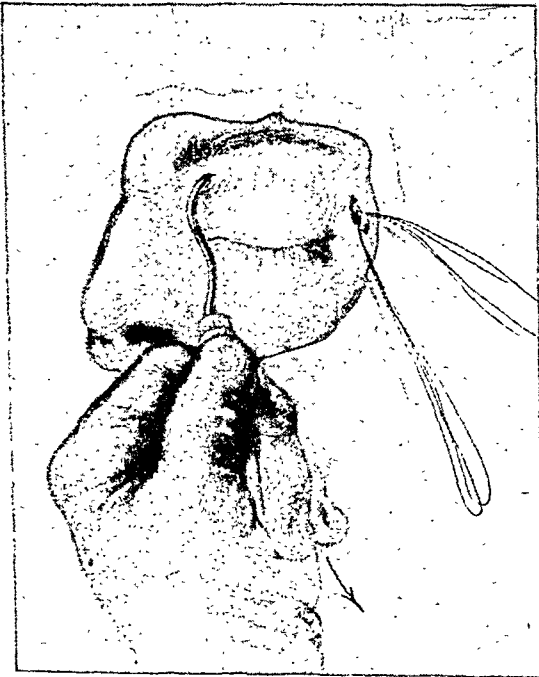


Fig. 2 (Cutler). Two loops of medium black silk are drawn through the tunnel in the lid.

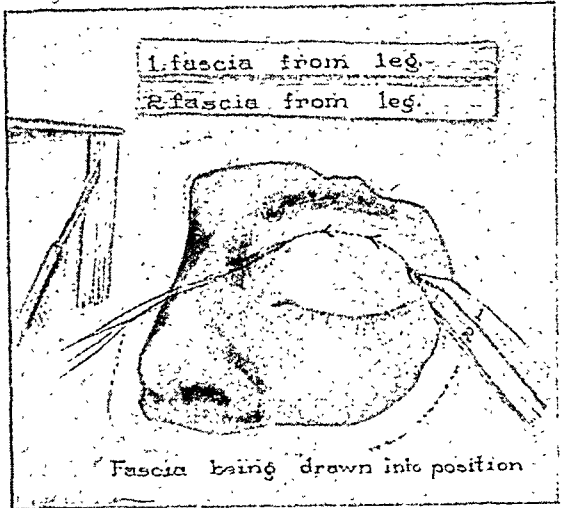


Fig. 3 (Cutler). Fascia being drawn into position.

to receive it, as described below.

Lid operation. The upper lid below the brow line is infiltrated with 2-percent novocaine and 1:50,000 adrenalin over an area extending from the nose to 2 cm. beyond the outer canthus. This procedure is advisable even if general anesthesia is used, as it facilitates dissection. A skin incision about 1.5 cm. long is made just lateral to the outer canthus and parallel to the curve of the brow. This is carried through the orbicularis. With curved scissors (Stevens or similar scissors), sharp and blunt dissection is used to tunnel under the orbicularis toward the nose, care being taken to follow the curve of the brow (fig. 1). Two loops of medium silk are now carried through the incision from the temporal side with an aneurysm needle. The loops protrude through the temporal incision (fig. 2).

Previously obtained fascia is then prepared and placed in the following manner: A double strip of fascia is laid along the curve of the lid and cut to the desired length. Two double strips of fascia are thus obtained. Each piece of fascia is then held in a mosquito clamp at the middle (fig. 3) and shredded with a sharp-pointed Bard-Parker knife. The fascia is smoothed flat and each strip laid

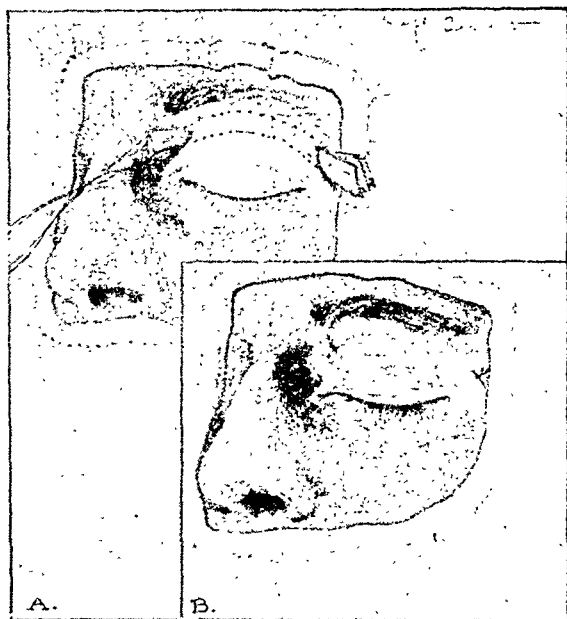


Fig. 4 (Cutler). A, fascia in position ready for tapering of ends. B, final closure.

through a separate loop of the previously placed sutures (figs. 3 and 4) and then drawn into the lid. The fascia should project a little through each incision. The sutures are cut and removed and the looped ends of the fascia cut. The protruding ends of the fascia are tapered with scissors and tucked under the orbicularis. The latter is then closed with one or two 4-0 chromic catgut sutures, and the skin is closed with one or two 4-0 silk sutures (fig. 4). The fascia is then massaged slightly to make sure that it is lying flat, and a Wheeler patch is applied. The prosthesis may be left in the socket if desired.

Postoperative course. The dressing is removed in three or four days and the skin sutures removed. If unusual lid edema is noted, a dressing may be reapplied for an additional two days. Some edema persists for a week to 10 days. In occasional cases, some edema may persist for several weeks. If, after all edema has disappeared, it is found that insufficient fascia has been implanted, an additional amount may be placed where it is

needed. If too much has been used, some of the strands can be readily removed.

Patients have been observed for periods up to four months. One patient was killed in an automobile accident approximately $3\frac{1}{2}$ months after the implantation. At autopsy the fascia was found to be unchanged in its original position (fig. 5). There was still some round-cell infiltration present. This patient had a somewhat prolonged edema of the lid postoperatively which gradually receded. The pre- and postoperative photographs are shown in figures 6 and 7. Following is the report of the pathologist:

"Sections through the fascia-lata implant in the left upper eyelid show viable fascia. There is no necrosis. There are, however, foci of granulomatous inflammation, characterized by exudation of lymphocytes, proliferation of histiocytes, and numerous foreign-body-type giant cells. There is also deposition of crystalline pigment, presumably hematogenous in origin. The fascia gives evidence of a foreign-body reaction."

Complications. The complications that may arise can, for the most part, be



Fig. 5 (Cutler). Drawing made at autopsy, $3\frac{1}{2}$ months after implantation of fascia.



Fig. 6 (Cutler). A, preoperative view of lid. B, two weeks' postoperative view of lid.



Fig. 7 (Cutler). A, preoperative view of patient in figure 5. B, 3 months' postoperative result.

guarded against. The fascia must be put in smoothly in order to insure a smooth appearance. It must be placed close to the brow line, and the lower side of the dissection must follow the curve of the brow. Otherwise, the fascia will take the shortest course across the lid and be too low.

Care must be taken to keep the fascia under the orbicularis to prevent scarring. One patient, for some reason, showed a

continued reaction and swelling for several weeks, and the fascia had to be removed.

SUMMARY

A procedure for restoring the normal upper-lid fold after enucleation, used on 134 patients, is described with a postmortem report on a patient operated on 3½ months earlier.

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NONPERFORATING CYCLODIATHERMY FOR THE TREATMENT OF GLAUCOMA*

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Vogt and his associates^{1, 2, 3}, have recently introduced the cyclodiathermy operation for the treatment of glaucoma. The operation employs a diathermy needle similar to that used for retinal separation to destroy a portion of the ciliary body by multiple punctures through the overlying sclera. An atrophy of the ciliary body has been confirmed histologically;^{1, 4} therefore a reduction in the formation of aqueous would be expected to follow. Vogt's procedure has been designated as "perforating cyclodiathermy" to distinguish it from the "nonperforating" method employed by Albaugh and Dunphy,⁴ who used contact with a broad electrode to the sclera over the ciliary region. The following report is based upon the observations made on 28 eyes afflicted with various types of glaucoma which were treated by nonperforating cyclodiathermy.

The operative procedure followed closely the originally described method.⁴ Subsequent to instillation of an anesthetic and a retrobulbar injection of procaine and adrenalin, a conjunctival flap was reflected toward the limbus over half the eyeball. The tip of a 2-mm. rounded electrode was used in the earlier operations, and later the flat end of a round stainless-steel pin 2 mm. in diameter. A small Bovie high frequency electro-surgical unit set at 35-40 furnished the coagulation current. The electrode was held in contact with the sclera from 4 to 5 seconds to form a single row of points over the

ciliary region. The amount of current, the time, and the degree of pressure upon the sclera are all variable and arbitrary. The optimum area of coagulation was for the 2 mm. covered by the tip of the electrode and extending for not more than 0.5 mm. beyond its edge. Coagulation exceeding this amount led to an excessive postoperative reaction. A closure with a tight running silk suture was found the most effective means of avoiding a postoperative retraction of the conjunctiva with an exposure of the treated portion of the sclera. In the few instances where retraction occurred, the sclera was slow in healing. Because of the possible danger of too extensive destruction to the anterior circulation of the eye, no more than two-thirds of the ciliary body was treated in any one eye. At first, because intraocular pressure was not immediately relieved by the operation, there was hesitation in employing atropine postoperatively. Later atropine was used routinely and in most instances was continued until the uveitis subsided. At the first dressing of the atropinized eyes, the pupils were dilated only in the segment not operated upon. These pupils remained permanently oval, and the iris failed to respond to light over the segment that had undergone operation.

Usually there was ocular pain for about 24 hours postoperatively, at which time the eyes were comfortable regardless of any abnormally high intraocular pressure. Albaugh and Dunphy⁴ attribute a postoperative rise in tension to a mechanical shrinking of the sclera with reduction of the total contents of the eyeball. Apart from this action there is the effect of the adrenalin used, for adrenalin temporarily

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reduces intraocular pressure in a glaucomatous eye although it may later induce a stasis and edema.⁵ The elevated tension is probably due principally to the injurious effect of the diathermy upon the endothelium of those vessels of the ciliary body that are not actually destroyed. The injury is comparable to a burn upon the body surface where the transudate accumulates in cutaneous blebs. Occurring within the unyielding confines of the eyeball, this process is followed by extreme elevation of intraocular pressure. Occasionally, to counteract this, the operation was followed by a paracentesis sufficiently large to remain open for at least 24 hours.

In most instances intraocular pressure dropped slowly and steadily for several days before it returned to normal. There was a further reduction to a point of extreme hypotony, lasting for weeks or until the uveitis subsided, when the tension returned to normal or again became elevated. During the stage of hypotony the anterior chamber was reduced as much as a third of normal depth. Several eyes were tender during this period. The pre-operative incompenation and high tension were never reached by such eyes as returned to a glaucomatous state postoperatively. A most striking sequel of the operation was the relief from ocular pain.

A constant occurrence was a faint opacification with anesthesia of one half to two thirds of the corneal surface corresponding to the treated segment of the bulbs. When three fifths of the ciliary region was treated, as much as four fifths of the cornea became anesthetic. For several subsequent weeks this hazy and anesthetic portion of the cornea dried quickly upon exposure. Later the corneal smoothness was completely restored, although in a few cases there were permanent deep nebulous opacities. These, however, may have arisen from the glaucoma. Corneal anesthesia over the segment

where it was first observed remained complete and unchanged in all these cases except one, where slight sensitivity returned. Some cases were under observation for more than two years. A number of cyclodiathermies were done upon the upper part of the bulb so that the anesthetic portion of the cornea was protected by the upper lid. This position of the cyclodiathermy did not interfere with a subsequent cataract extraction through an enlarged superiorly located keratome incision under a conjunctival flap in case 19. In case 13, the cyclodiathermy was below, the cataract incision located above.

A uveitis with a cyclitis of variable severity and duration follows the necrosis of the ciliary body and overlying sclera. In this series there was a greatly increased aqueous ray which sometimes lasted for months. However, cells were infrequent in the anterior chamber. Some degree of posterior synechia usually occurred, and a mild iris atrophy was a frequent late finding. A thin membrane formed across the pupillary area of the aphakic eyes. Unless emptied by paracentesis, the anterior chamber usually remained at least partly formed, which is favorable in avoiding peripheral synechia.

Danger of a direct thermal injury to the lens at operation seems improbable. Following any of the usual operations for glaucoma, even when no apparent injury occurs to the lens, cataractous changes are prone to form. With the use of cyclodiathermy a sudden acute fall of intraocular pressure is avoided. A possible danger to the lens exists in its exposure to an extreme hypotony, an iridocyclitis, and to the degenerative products from the tissues destroyed by the diathermy current.

In spite of the destruction of a substantial part of the aqueous-forming structures, some eyes returned to an abnormally high tension when recovery from the operation had occurred and when the

TABLE 1
DATA ON 28 CASES OF GLAUCOMA TREATED WITH CYCLODIATHERMY

Case	Patient Age, Sex	Diagnosis and Previous Treatment	Vision and Tension before Cyclodiathermy	Cyclodiathermy	Results
1.	80 ♂	Eye blind for 7 yrs. Iris atrophic, vascularized.	No light perception; tension 55 mm. Hg	Lower 1/3	4 dys. postoperatively, tension 30 mm.; 3 wks., 21; 2 mos., 16.
2.	59 ♂	Bilateral old retinal separations. Left eye painful, irritated. Mild diabetes.	No light perception; tension 90 mm. Hg	Upper 2/5	1 month postoperatively, tension 35 mm. No pain. Patient died soon after this from uremia.
3.	76 ♀	Acute congestive glaucoma 10 wks. following extracapsular combined lens extraction. Miotics failed.	6/200 (previous to cataract removal); tension 90+ mm. Hg	Upper 3/5	Tension followed for 16 mos. never above 21 mm. Corrected vision 6/7.5-2; Field, white 3/1000 5 8 27
4.	67 ♀	Irritation and pain 10 wks. after right central venous thrombosis. Miotics failed.	Light perception; tension 90 mm. Hg	Upper 3/5	1 wk. postoperatively, tension 42 mm.; 2 wks., 30; 5 wks., 25; 6 wks., 35.
5.	80 ♀	Right eye painful and congested for 10 dys. following central venous thrombosis of unknown duration.	Light perception; tension 90 mm. Hg	Upper 1/2	2 dys. postoperatively, tension 47 mm.; 4 dys., 55; 4 wks., 65; 5 wks., 80. No pain. Light perception.
6.	60 ♂	Left extracapsular lens extraction.* iridencleisis* 4 yrs. previously. Eye painful, congested.	No light perception; tension 90+ mm. Hg	Lower 1/2 (lightly)	2 dys. postoperatively, tension 35 mm.; 3 dys., 23; 3 mos., 55. No pain.
7.	66 ♀	Intracapsular combined cataract extraction* 1 yr. previously. Compensated glaucoma. Miotics failed.	6/10; tension 56 mm. Hg	Upper 2/3	1 dy. postoperatively, tension 21 mm.; 21 mos., 21. Corrected vision 6/10-2; Field 15 40 15 38
8, 9.	52 ♀	In May, 1942, left acute congestive glaucoma for 33 dys.; right for 4 dys. "Rubeosis iridis." Severe vitreous hemorrhage. Moderate diabetic. Miotics failed.	R., 3/200, tension 90 mm. Hg; L. hand movements at 2 ft., tension 55 mm.	Lower 1/2 of each eye	3 dys. postoperatively, R. tension 40 mm., L. 55; 4 dys., R. 35, L. 40; 6 dys., R. 21, L. 25; 7 dys., R. 15, L. 17. Vision R. 7/200, L. 3/200. 30 mos. severe with atrophic changes.
10.	80 ♀	Intracapsular combined cataract extraction* 3 yrs. previously. Moderate bullous keratitis. Miotics failed.	No light perception; tension 40-65 mm. Hg	Lower 1/2	4 days. postoperatively, tension 21 mm. 6 mos., 21.
11.	68 ♂	Incompensated glaucoma 5 wks. after intracapsular combined cataract extraction. Miotics failed.	Light perception (previous to cataract operation); tension 40 mm. Hg	Lower 1/2	Moderately severe postoperative reaction; 1 yr. postoperatively tension 10 mm. Corrected vision 6/30.
12.	55 ♀	Bilateral chronic glaucoma untreated for 9 yrs. Right absolute glaucoma.	R. no light perception; tension 90 mm. Hg	Lower 2/5	Phthisis bulbi. 3 mos. postoperatively enucleated.
13.	75 ♂	Chronic uveitis. Iris congested. No posterior synechia. Immature cataract. Cycloplegics failed.	Hand movements; tension 60 mm. Hg	Lower 1/3	2 dys. postoperatively, tension 40 mm.; 7 wks., 21; 6 mos., 16; 18 mos., extracapsular combined lens extraction. Vision: hand movements.
14.	73 ♀	Acute congestive glaucoma. Trephining* failed.	Light perception, tension 90+ mm. Hg	Lower 1/2	4 mos. postoperatively, tactile tension normal. Light perception.
15.	59 ♀	Central venous thrombosis 1 yr. previously. A painful, congested eye with hyphemia.	No light perception.	Lower 3/5*	Lens changes and posterior synechia. For 1-1/2 yrs. postoperatively, hypotony and free of pain.
16.	69 ♂	Bilateral acute congestive glaucoma. Left basal iridectomy* 2 yrs. previously. Miotics failed.	6/60; L. tension 90+ mm. Hg	Lower 1/2	3 dys. postoperatively, tension 35 mm. 3 wks., 25; 6 wks., 35. For 16 mos., 16-20 under miotics. Vision 6/60; Field, white 7/1000 12 12 30 18
17.	37 ♀	Glaucoma 9 dys. after central venous thrombosis. Moderate incompensation. Blood pressure 226/130.	Finger counting; tension 55 mm. Hg	Upper 1/2*	10 dys. postoperatively, tension 20 mm. eyeball white in 2 mos.; 15 mos., tension 18.

TABLE 1—*Continued*

Case	Patient Age, Sex	Diagnosis and Previous Treatment	Vision and Tension before Cyclodiathermy	Cyclodiathermy	Results
18, 19.	53 ♂	Right chronic simple glaucoma. Trephine* 2 yrs. previously failed. Uncooperative in use of miotics. Left traumatic cataract of 24 yrs. duration. Posterior synechia, exotropia.	6/200; tension 40 mm. Hg Hand movements; tension 40 mm. Hg	Upper 1/2 Upper 1/2	3 wks. postoperatively, tension 16 mm.; 4 wks., 29; 11 mos., 21; 23 mos., 21. Vision 1/200 3 wks. postoperatively, tension 23 mm.; 4 wks., 34; 11 mos., 25 when traumatic cataract was removed through enlarged upper keratome incision and broad basal iridectomy; 23 mos. after cyclodiathermy, tension 30. Corrected vision 6/15—2. Field white 3/1000 45 40 40
20.	65 ♀	Extracapsular combined right cataract extraction* in 1936, and a later iridotomy* June, 1942. Pain and congestion. Fresh vitreous hemorrhage. Moderate diabetic.	Light perception; tension 30 mm. Hg	Upper 1/2	9 mos. postoperatively, tension 8 mm. No light perception.
21.	73 ♀	Bilateral chronic simple glaucoma. Right eye blind for 7 yrs. Moderate bullous keratitis. Slight congestion.	R. no light perception; tension 90+ mm. Hg	Upper 1/2	5 dys. postoperatively, 41 mm.; 10 dys., 25; 2 mos., 16; 1 yr., 10.
22.	68 ♀	Pain, congestion, iris vascularization, posterior synechia, 8 mos. after central venous thrombosis.	No light perception; tension 90+ mm. Hg	Upper 2/3*	For 2 yrs. postoperatively, comfortable, without pain. Phthisis bulbi.
23.	62 ♀	Intracapsular combined lens extraction* July, 1941. Sept., 1941, tension 40 mm. March, 1942, tension 46. Cyclodialysis,* miotics failed. Eye irritated for 11 mos.	Finger counting; tension 55 mm. Hg	Upper 1/2	2 dys. postoperatively tension. 11 mm.; 2 wks., 13; 2 mos., 29. Corrected vision 6/30. Comfortable.
24.	78 ♀	Bilateral acute congestive glaucoma superimposed upon chronic simple glaucoma. Miotics failed.	Hand movements; L. tension 80 mm. Hg	Upper 1/2 (Left)	1 wk. postoperatively, tension 19 mm.; 5 wks., 12; 2 mos., 48. Vision 6/200. Moderate cataractous changes and posterior synechia. Returned to miotics.
25.	65 ♀	Painful, congestive glaucoma 31 dys. following central venous thrombosis.	Light perception; tension 90 mm. Hg	Lower 1/2*	2 dys. postoperatively, tension 48 mm. Eye injected for 6 mos. Tension 20 or lower for 2½ yrs. Lens cataractous; posterior synechia. Comfortable without treatment.
26.	55 ♂	Internal strabismus, amblyopia exanopsia. Acute congestive glaucoma. Trephine, miotics failed.	Hand movements; tension 90+ mm. Hg	Lower 2/5	5 mos. postoperatively, hypotony. Phthisis bulbi.
27.	49 ♀	Bilateral chronic simple glaucoma. Trephining* failed. Right acute congestive glaucoma. Miotics failed.	Hand movements; tension 90+ mm. Hg	Lower 1/2	For 16 mos. postoperatively, tension 30–40 mm. under miotics. Vision 6/7.5. White field 3/1000 35 35 38
28.	53 ♀	Anterior uveitis with old central chorioretinitis. Eye painful, congested. Vascularization of iris sphincter. Corneal precipitates. No posterior synechia.	Fingers at 1 ft.; tension 70, after atropine 50 mm. Hg	Lower 1/2	3 dys. postoperatively, tension 23 mm.; 6 dys., 16; 2 mos., 9; 5 mos., 16. Uveitis quiescent. Vision: fingers at 1 ft.

* Operation not performed by author.

I am indebted to Dr. John F. Gipner for permission to include Cases 15 and 22, and to Dr. Charles T. Sullivan for Cases 17 and 25.

tone of the eyeball was reestablished.

The majority of the cases in this series were in a state of vascular stasis and congestion preoperatively. Following operation, an uncompensated phase was not again observed in any of these eyes.

In cases 24 and 27 (chronic simple glaucoma which had become uncompensated) there was relief from the acute state but they became stabilized at a glauco-

matous level. In these the reelevation of intraocular pressure occurred before the uveitis completely subsided. One is thereby confronted with the problem of whether or not to continue to treat the uveitis in an eye requiring a miotic for the glaucoma.

The operation was most successful in the aphakic group. Tension was controlled in five of the six cases of aphakia that

were secondary to cataract extraction.

The pain, incompensation, and at least part of the irritation were relieved in glaucoma secondary to central venous thrombosis. As the atrophy of the iris became more apparent, the uveitis in these eyes improved. A reduction in the number of new blood vessels upon the iris was not limited to the iris segment corresponding to the treated side of the eye.

Glaucoma with rubeosis iridis in diabetics offers a no less hopeless prognosis. The neovascularization of the iris is a contraindication for intraocular surgery. In the single case (case 8) of rubeosis iridis treated by cyclodiathermy, the tension was controlled, but a later severe proliferating retinosis with an enormous number of new retinal blood vessels led to retinal separation and degenerative changes. Case 28 was a secondary glaucoma with anterior uveitis accompanying extensive vascularization over the sphincter muscle in a distribution similar to that observed in cases of acute rubeosis iridis. There were no posterior synechia. After cyclodiathermy, the congestion and pain disappeared, the tension remained within normal limits, and the uveitis subsided.

In those cases where more advanced

degenerative changes were apparent and in absolute glaucoma, the operation tended to hasten the degeneration.

The possibility of the glaucomatous eye containing a neoplasm must always be eliminated.

CONCLUSIONS

In every instance where cyclodiathermy is contemplated one should not minimize the damage to the integrity of the eyeball, the unpredictable severity and frequently prolonged period of the postoperative uveitis, nor the uncertainty of a permanent control of the glaucoma. The operation is particularly suited to glaucoma where iris vascularization precludes surgery upon the iris, and to glaucoma secondary to central venous thrombosis. In the latter group, tension was not always controlled, but pain was relieved.

Cyclodiathermy may be chosen as an operative procedure for some desperate cases, wherein already proved treatments for glaucoma have failed. It can be recommended in hopeless cases for the relief of glaucomatous pain in preference to enucleation, retrobulbar injection of alcohol, or to the X ray.

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STEVENS-JOHNSON'S DISEASE*

A CASE REPORT

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Stevens-Johnson's¹ disease is comparatively rare. It is generally a pediatric problem, but our case occurred in a patient 56 years of age.

The etiology is unknown.

The onset is somewhat acute, with headache, anorexia, chilly sensations, fever, joint aches and pains. A coryza is often associated, and sometimes a mild bronchitis.

There is a moderate to profuse suppurative conjunctivitis.

The skin generally exhibits macules, papules, and vesicles. The buccal surfaces, the palate, the vaginal mucosa and the glans penis, also may exhibit these lesions.

The white-cell count usually reveals a slight leucocytosis.

The disease appears to be self-limited.

Stevens and Johnson¹ in 1922 reported two cases of eruptive fever with stomatitis and ophthalmia. This condition has since been called Stevens-Johnson's disease or syndrome. It is also known as erythema multiforme exudativa, with stomatitis and ophthalmia. Von Hebra² in 1866 first described erythema multiforme as a skin eruption of macules, papules, and vesicles upon the face, neck, arms, and legs without marked general symptoms. This more rare type, however, has marked general symptoms, fever, malaise, prostration, and other signs, as well as a severe purulent conjunctivitis and stomatitis.

CASE REPORT

B. B., an American housewife born of

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Irish parents, aged 56 years, was admitted to the hospital, moderately ill.

She had been married for 35 years and had no children.

The personal and past histories had no bearing on the case.

The onset of the disease occurred about 10 days prior to her admission. At first she noticed a muscular soreness of the legs followed by the appearance of an erythematous rash on the tibial surfaces of



Fig. 1 (Jones, Talbot, and King). Lesions on the lips, nose, and eyes.

both legs. The illness was diagnosed by the patient as la grippe and was promptly followed by nasal congestion, sore throat, and a purulent conjunctivitis, with a free conjunctival discharge. Sulfathiazole to be taken orally was prescribed by a private physician, also moist dressings to the legs and irrigation of the eyes with a saturated solution of boric acid. This medication was begun three days before admission. Because the condition did not improve but became progressively worse, the patient sought admission to the hospital (fig. 1).

A digest of the hospital record follows:

The admission temperature was 100° F., rectally; pulse 90; respirations 26, there was an eruption on the skin of the tibial surfaces of both legs (fig. 2). These

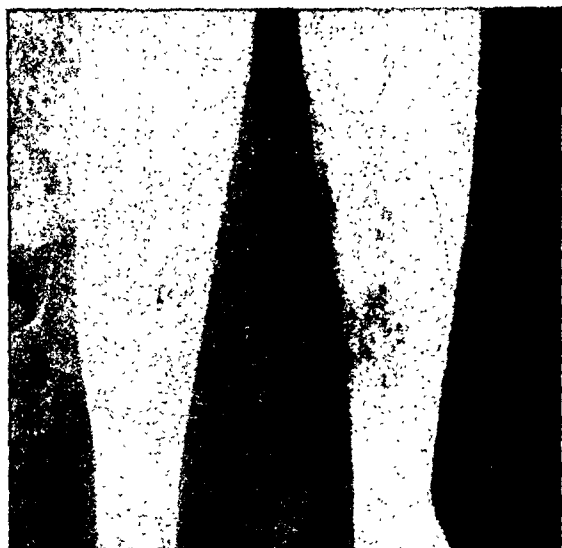


Fig. 2 (Jones, Talbot, and King). Cutaneous lesions on the legs.

lesions were chiefly macular, some were papular, and a few petechial. Some areas were discrete, with normal skin intervening. In color they varied from a bright red to a dusky blue. Other areas were confluent. The lips were dry, cracked, and presented some maculo-papular eruptions with an erythematous areola. Lesions of like character were found at the mucocutaneous junction of the nasal orifices. There was marked crusting of mucus to the point of occlusion of the nasal cavities.

The buccal mucosa also presented some small, raised pustular lesions, and a small pustule was observed on the tongue. There was a foul odor from the mouth.

The lymphatic tissue in the pharynx was hypertrophied. The cervical lymph nodes were enlarged but not tender.

The eyelids were swollen, their margins covered with thick pus, and the cilia were matted together. On separating the lids, the eyeball was found to be smeared with

mucopus (fig. 3). The palpebral conjunctivas were turgidly congested exhibiting prominent follicles and small pustular lesions. The bulbar conjunctivas similarly were markedly injected and chemotic with a definite overhanging of a portion of the cornea. The cornea of the left eye presented an old scar about which no history was obtainable. The pupils were moderately contracted and responded adequately in their several reactions.

The iridic structures were not remarkable.

The anterior chambers were not shallow, and the tension was not raised.

The examination of the fundus revealed a moderate arteriosclerotic retinopathy.

The bulbs were sensitive and somewhat painful. The patient complained bitterly of light sensitivity. Visual acuity was markedly diminished. There was no blepharospasm.

No lesions of the vaginal mucosa were apparent.

The symptoms and signs gradually abated. The temperature continued ele-



Fig. 3 (Jones, Talbot, and King). Right eye showing marked injection and chemosis.

vated for a period of 10 days, never more than 102° F., rectally.

The pulse remained elevated throughout the course of illness. The respirations were within normal range.

The ocular, nasal, buccal, and cutaneous pathologic processes receded gradually.

Two weeks after admission to the hospital the patient's vision was O.D. 15/40—2, O.S. 15/30—2. The right eye seemed to be more affected than the left. The purulent discharge had subsided considerably; the chemosis had gone. The conjunctival injection although still quite marked did not have the beefy-red appearance of two weeks ago. During her stay in the hospital, on about the third week, the patient became psychotic. A latent paranoid trend was reported by the psychiatrist. The mental picture has not changed up to the present writing.

The ocular, nasal, buccal, and cutaneous lesions have subsided.

Epithelial scrapings from the conjunctival cul-de-sacs showed no inclusion bodies. Nor did those taken from the vagina and urethra.

Cultures of the conjunctival mucopurulent discharge revealed a heavy growth of *Staphylococcus aureus hemolyticus*. Sedimentation rate was 48 mm. in one hour. The leucocyte count was 15,100; in the differential, the lymphocytes dominated.

The urinalysis was negative as was also the blood Wassermann test. Blood pressure and electrocardiogram were within normal limits. The spinal tap and fluid were not remarkable.

The X-ray studies of the chest, skull, and sinuses revealed no pathologic change.

Penicillin, 2,500 units per cubic centimeter, was used topically in each eye, accompanied by boric-acid eye irrigations and cold moist packs.

REVIEW OF THE LITERATURE

Both cases in the report of Stevens and Johnson¹ were in children aged 8 and 7 years, respectively. There was severe purulent conjunctivitis, fever, malaise, and a fairly generalized skin eruption. In one case the ocular involvement went on to panophthalmitis and blindness in both

eyes. In the other case, one cornea cleared completely, a scar remaining in the other eye. Cultures from the nose and throat yielded cocci and bacilli. Cultures from a papule revealed *Staphylococcus aureus*. Blood culture was negative. There was a mild leucocytosis.

A general blood-stream infection was suspected, without positive evidence.

In 1929 Rutherford³ wrote a paper on membranous conjunctivitis, which is not within the scope of this paper.

In 1931, J. H. Bailey⁴ reported three cases and reviewed the literature on erythema exudativum multiforme for a period of 64 years. He concluded that the disease was caused by some infection of unknown origin and he suggested that the disease was more common than is usually thought to be the case. The quoted references definitely refer to erythema exudativum multiforme, and the fact that the disease may involve the mouth and eyes.

We question seriously whether these references pertain to the Stevens-Johnson disease entity.

Wheeler in 1930⁵ saw a case that ended in the loss of both eyes. His case emphasizes the importance of recognizing the disease, and the serious ocular sequelae which may ensue.

Ginandes in 1935⁶ reported a case in a child 5½ years of age. His case presented membranes of the palpebral conjunctivas and, in our opinion, does not properly belong in the group of Stevens-Johnson's syndrome.

Edgar and Syverton⁷ in 1938 reported two cases in children, aged 12 and 15 years, which showed recurrences and resulted in little ocular damage. These writers were fortunate in having had their cases under observation for a considerable period of time, and investigative work was done on them: A mild leucocytosis was present; blood cultures were sterile, nose

and throat cultures revealed *Streptococcus haemolyticus*, those from conjunctival and mouth lesions showed *Staphylococcus aureus*. Biopsy examination of a lesion revealed a mild exudative to a mild inflammatory reaction. Their investigation failed to show the presence of any infective agent in the serum of the vesicular lesions.

There was some thought that an anaphylactic phenomenon was involved.

Givner and Ageloff⁸ in 1941 reported two cases, one in an adult 23 years of age, the other in a child of 4 years. These writers were unable to find elementary bodies in the vesicular fluid or to develop a virus on chorioallantoic membrane of the chick.

Murphy⁹ in 1944 saw a case in an adult 22 years of age. He expressed no new opinion.

INVESTIGATIVE

We examined epithelial scrapings for some evidence that would point to virus disease. We failed to find inclusion bodies in (1) Daily examination of epithelial scrapings from the conjunctiva, stained by Wright's stain (which also failed to show initial bodies) and (2) in epithelial scrapings from the urethra stained by Wright's stain.

In the fifth week of the disease, 30 c.c. of blood was removed, allowed to stand 24 hours in the refrigerator, then centrifuged and the serum poured off. This serum was sent to Dr. K. F. Meyer, Hooper Foundation, University of California, who examined the serum for the presence of antibodies of the psittacine group of viruses. He reported that the patient's sera fixed complement in the presence of *Psittacosis* antigen in serum dilution 1:32 (4 plus) and 1:64 (3 plus).

DISCUSSION

It is now generally accepted that

Stevens-Johnson's disease is a definite entity. Duke-Elder¹⁰ classifies ocular erythema multiforme into three groups: I. The catarrhal type, which is a mild type; II. The purulent type, a rare type which is more severe than the catarrhal; III. The membranous type, usually the most severe, and the more common, which often produces serious ocular damage. Type II he calls Stevens-Johnson's syndrome.

We believe that the name Stevens-Johnson's disease should be reserved for those cases which present purulent conjunctivitis, stomatitis, and a cutaneous rash, without the formation of a membrane. We were able to find only 11 cases which seem to fall in this group. Our case belongs in this group.

In Givner's case⁸ is found the first report of the disease in an adult.

Our case would seem to have appeared in the oldest patient reported, and it together with two others observed in adults, would definitely indicate that this disease is not confined to the age of earlier childhood.

To avoid confusion as to classification of the disease, it would seem best to continue to apply the name Stevens-Johnson's disease to those cases exhibiting a purulent conjunctivitis, and excluding those with catarrhal or membranous characteristics.

While penicillin was used in the eyes, we have no evidence that it was effective.

Flushing the conjunctival sac and instilling antiseptics may bring about the same result.

SUMMARY

Stevens-Johnson's disease is a rare type of erythema exudativum multiforme. It is a definite entity, and may occur at any age and in either sex. Its etiology has not been determined.

We wish to thank Dr. H. T. Schweitzer for his assistance.

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CONGENITAL GLAUCOMA FOLLOWING MATERNAL RUBELLA*

REPORT OF TWO CASES

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The timely report of Reese¹ in this country and of Gregg² in Australia concerning congenital cataract following German measles in the mother has occasioned widespread interest and has resulted in bringing to light many cases whose etiologic background would have otherwise remained obscure. In these reports as well as that of the National Health and Medical Research Council of Australia³ other congenital anomalies such as heart disease, microcephaly, microphthalmia, feeble-mindedness, deaf-mutism, and hypospadias were found occurring concomitantly with the cataracts, but of all the cases reported only one is said to have had congenital glaucoma. The recent occurrence in the author's private practice of congenital glaucoma in two children whose mothers suffered from an attack of German measles during early pregnancy suggests that such an anomaly may also be a common sequela of German measles, and that careful inquiry into the history of all cases of congenital glaucoma may reveal the rubella taint in many cases. The literature pertaining to this problem has been adequately reviewed by Reese.

CASE REPORTS

Case 1. R. J., a boy, 3 years of age, a private patient of Dr. Lee Sutton was admitted to Medical College of Virginia Hospital on January 25, 1945. Delivery had been spontaneous, without undue trauma, and the birth weight was 7½ pounds. Family history was negative ex-

cept for the mother's having had German measles between the first and second months of pregnancy. From birth the child was mentally retarded. He walked when supported at two years but never learned to talk. A convergent squint had been present from birth as had congenital cataracts. Shortly after birth wandering nystagmus appeared. The child had always been a feeding problem and for the six months preceding hospitalization he had constantly lost weight and strength. In addition, spasticity of the leg muscles was noted, and a constant side-to-side rolling of the head developed. The diagnosis of rickets was made and treatment for this was instituted by the family physician. When, in spite of treatment, the child became progressively more spastic, and decubitis ulcers developed, meningitis was suspected, and the child was referred to Dr. Sutton for diagnosis and treatment.

At the time of admission the following abnormalities were noted on physical examination: Marked malnutrition; congenital cataracts and convergent squint; alopecia areata, occipital region; generalized lymphadenopathy; marked dental caries; questionable Harrison's groove and rachitic rosary; slight tremor of hands; blowing systolic murmur at apex; spasticity of leg muscles; pale mucous membranes; decubitis ulcers over buttocks; weight, 17 pounds.

Except for a severe hypochromic anemia with marked red-cell regeneration and pseudomacrocytosis, and a leucocytosis of 25,000 with myeloblasts, promyelocytes, and occasional normoblasts, the

* Read before the Virginia Pediatric Society on June 8, 1945.

laboratory findings were normal. Skull X-ray studies revealed moderate convolitional atrophy. The diagnosis of congenital idiocy, congenital cataracts, malnutrition, and hypochromic anemia was made and the child placed on a high-caloric, high-vitamin diet. Transfusions were given and ferrous sulfate prescribed for the anemia.

Eye consultation revealed the following changes: The patient followed light. The eyes were microphthalmic. There was a convergent squint of 40 degrees Hirschberg, with wandering nystagmus. Moderate bilateral corneal edema was observed in the central portion, more in the left eye than in the right. The corneas measured 10 mm. The anterior chambers were shallow. The pupils were moderately dilated and fixed; the lenses showed fairly dense nuclear cataracts with clear cortex. The fundi gave a good reflex. The patient was too uncoöperative for detail. Tension was 4+ to fingers. The impression was: 1. Convergent squint. 2. Congenital glaucoma. 3. Congenital cataracts. 4. Microphthalmia.

Examination of the eyes was then carried out under ether anesthesia. A fair view of the fundi was obtained and extreme glaucomatous cupping was found. Fairly dense cataractous changes confined to the nuclear region were also present. Tension with the Schiøtz tonometer (7.5-gram weight) was over 40 mm. in both eyes. An attempt was then made to carry out an iris-inclusion operation on the right eye. Immediately on opening the globe with the keratome, the cornea cleared but when an attempt was made to grasp the iris with forceps it was found to be friable and bound down firmly to the lens so that incarceration was impossible. A modified Lagrange operation was therefore carried out by punching out a portion of the anterior scleral lip with the Castroviejo punch. Following

the operation filtration was established and the tension well controlled.

At a later date a similar operation was carried out on the left globe. In this instance, however, little corneal clearing resulted.

Shortly after the last operation the patient developed chicken pox, which necessitated his isolation. In spite of this he improved progressively and when discharged on April 15, 1945, his general condition was much improved and his intraocular pressure was normal to fingers. The patient is to return in the near future for needling of the cataracts.

Case 2. B. C., a white girl aged 3 years, was brought for ophthalmologic attention on April 14, 1945, because of a "large left eye which keeps getting bigger." Birth had been spontaneous, and no abnormalities were noted at that time. Her birth weight was 7 pounds. The family history was negative except for the mother's having had a moderately severe attack of German measles between the second and third months of pregnancy.

About five to six months postpartum, the parents began to notice that the left eye was "getting bigger." Nothing was done about the condition until the child was three years old, when the affected eye had become unsightly. Useful vision had never been present in the left eye.

Physical examination except for the eye findings was entirely negative.

Eye examination revealed the following changes in the left eye. The right eye was normal. Vision, O.D., follows light well. No coöperation for "E" chart; O.S., No light perception. Externally the left eye was prominent and cornea large (14 mm.), with numerous horizontal ruptures of Descemet's membrane. The pupil reacted consensually but not to direct light. The muscle balance was normal. Tension O.S. was 3+ to fingers. The

anterior chamber was very deep; the fundus showed a pale disc, with deep cupping and vessels pushed nasally.

Examination under ether followed by iris inclusion was advised, but the parents have so far refused to allow these procedures to be carried out. An interesting sidelight in regard to this case—and totally without confirmation—concerns the history. The mother stated that at the time she had rubella two of her friends whose pregnancy was of about the same stage as hers also contracted the disease. When they came to term, one gave birth to a "blue baby that died after two days"; the other gave birth to an infant which had "a big eye just like my child's." Since that time the friend whose baby had the "big eye" has moved elsewhere and she has consequently lost contact with her.

DISCUSSION

The clinical evidence at hand allows no modicum of doubt that congenital cataract as well as other anomalies can follow in the wake of maternal rubella. The cry of "post hoc" type of reasoning cannot be raised here, for already cases in this country and abroad are sufficiently numerous to rule out the operation of simple coincidence. When further data have accumulated it may well be that congenital glaucoma will be found to be a more frequent sequela of this disease than is indicated by the report of only one case in the entire Australian series. In that series, while there was only one frank case of buphthalmos, three other cases of corneal clouding, highly suggestive of glaucoma, are mentioned. Since congenital glaucoma, although present at birth, is frequently not diagnosed until later and even then at times diagnosis may be extremely difficult, it is not unlikely that cases from this series have since appeared and will eventually be reported. This is well illustrated by the second case report.

In this instance the signs of buphthalmos were not noticed until the child was at least six months old. On the other hand the Australian epidemic may have had a particular penchant for cataract formation whereas other epidemics may result in anomalies of another character.

There has been considerable discussion as to whether or not the maternal rubella responsible for the congenital anomalies cited is the time-honored disease, some variant, or perhaps an entirely new entity. As yet this question also remains unanswered. From reports thus far, though, it appears that the disease responsible is rubella and that only recently have we realized its full potentialities. Indeed there is an old-wives' tale, well known amongst the laity, to the effect that "if a mother has German measles while pregnant it will settle in the baby's eyes." Here again we may find operative the principle that superstitions many times precede medical thought by centuries—as in the case of the old Mosaic law postponing circumcision until the eighth postpartum day when the prothrombin concentration has reached a safe level—only to receive scientific backing in this "enlightened" century.

The question as to what is the best method of handling these cases is an important one. Primarily, our efforts should be expended in preventing maternal rubella by such procedures as strict isolation of expectant mothers during an epidemic and by the use of convalescent serum in those exposed. If, in spite of these measures, rubella develops during the first two months of pregnancy therapeutic abortion should be seriously considered and the prospective mother should be given the facts and allowed to make her decision.

In those instances wherein a defective child has been born the particular anomaly present must be treated. If cataract alone

is present, needling should be carried out as soon as the infant's general condition permits; if glaucoma is present, an iris-inclusion operation followed by massage should be the method of choice, and if cataracts are present, needling should be postponed until the tension is controlled.

SUMMARY

Two cases of congenital glaucoma following maternal rubella during the first and second months of pregnancy are reported.

503 Professional Building.

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HETEROGENEOUS CONJUNCTIVAL TRANSPLANTATION*

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Heterogeneous conjunctival transplantation offers many possibilities in ophthalmology. Great impetus has been given this procedure through the remarkable research of Russian workers in the field of tissue therapy. They have uncovered an entirely new phase of medicine and surgery almost as startling in approach and as breathtaking in scope as the historical contributions of Pasteur and Lister.

One of the foremost of the Russian ophthalmologists, V. L. Filatov,¹ for the past 10 years has been grafting animal tissues, particularly conjunctiva, refrigerated for several days before transplantation. He suggested that the tissues be removed under strict asepsis within 10 hours after death and transferred to a dry sterile bottle which should be kept at a temperature of 2 to 4°C. for seven days. He has shown that at the end of

this time any spirochetal infection will have totally disappeared. Substances which stimulate biochemical processes known as "biogenic stimulators" seem to accumulate in these refrigerated tissues, which can be transplanted more effectively than fresh tissue. Filatov has shown that these "biogenic stimulators" occur in many tissues, amongst which conjunctiva is included. The tissues are usually stored with the underlying subcutaneous structures but are freed of excessive elements at the time of transplantation.

Case report. The patient, a man aged 26 years, had incurred a very severe lime burn when he was 12 years old. The eye remained inflamed for several months, the process terminating in a very dense, vascularized corneal scar through which none of the inner structures of the eye could be observed. The upper lid was adherent to the globe, producing a ptosis. Light projection was faulty. The eye was constantly red, somewhat divergent, and teared readily in light. Many vessels ran

* Owing to the author's assignment to overseas duty, his corrected proof has not been available.



Fig. 1. (Rosen). Appearance of the left eye before operation. The adhesion of the upper margin of the tarsus to the eyeball proper makes it quite difficult to evert the lid.

throughout the substance of the cornea, which was somewhat thickened in cross section. The patient was referred from another hospital for enucleation, but because of the adhesion of the upper lid to the globe it was apparent that an attempt at a plastic repair should first be made before enucleation was considered. Oral mucous membrane was at first suggested as transplant tissue but cadaver conjunctiva became available at about this time and its utilization was undertaken.

Local anesthesia was administered (2-percent butyn alternated with 4-percent cocaine) and the adhesion which existed between the upper border of the upper tarsus and the conjunctiva just above the limbus was severed along a horizontal line. Upon completion of this dissection a spindle-shaped defect in the conjunctiva became apparent through retraction and release of the adhesion. The exposed defect was approximately 20 by 16 mm. in area. A similarly shaped piece of conjunctiva was cut out of the donor's conjunctiva. Two anchor sutures of 4-0 silk were placed at the terminals of the spindle, which was turned upon its episcleral surface and then thinned down to a minimal thickness. One end of the

spindle was then anchored to the corresponding angle in the eyeball and sutures were inserted along the upper and lower edges with 6-0 silk. The overlapping tissue was trimmed down before the final suturing was made to the external angle of the spindle. The flap was not stretched. Sulfathiazole ointment (5 percent) was placed in the cul-de-sac, following which an alginate substance was poured into the socket which rapidly hardened into a very efficient and rather thick stent. The eye was covered over with a tight pressure bandage which was retained for four days. At the end of five days the alginate stent, which now resembled a rubberlike mold of the conjunctival sac, was removed. The graft appeared to be in good position and of good color. Upon the thirteenth day postoperatively the patient complained of pain in and about his left eye, and it was observed that the right upper lid was edematous. Inspection of the flap showed a hemorrhage beneath the graft. A strong pressure bandage was applied to the left eye for 72 hours. Upon removal of the dressing the edema of the lids and the hemorrhage were seen to have disappeared. On the 25th day there was no indication of any complication, the



Fig. 2. (Rosen). The appearance of the left eye six weeks after operation. The tarsus is no longer bound down to the eyeball and the lid can be readily everted. An upper cul-de-sac is now present.

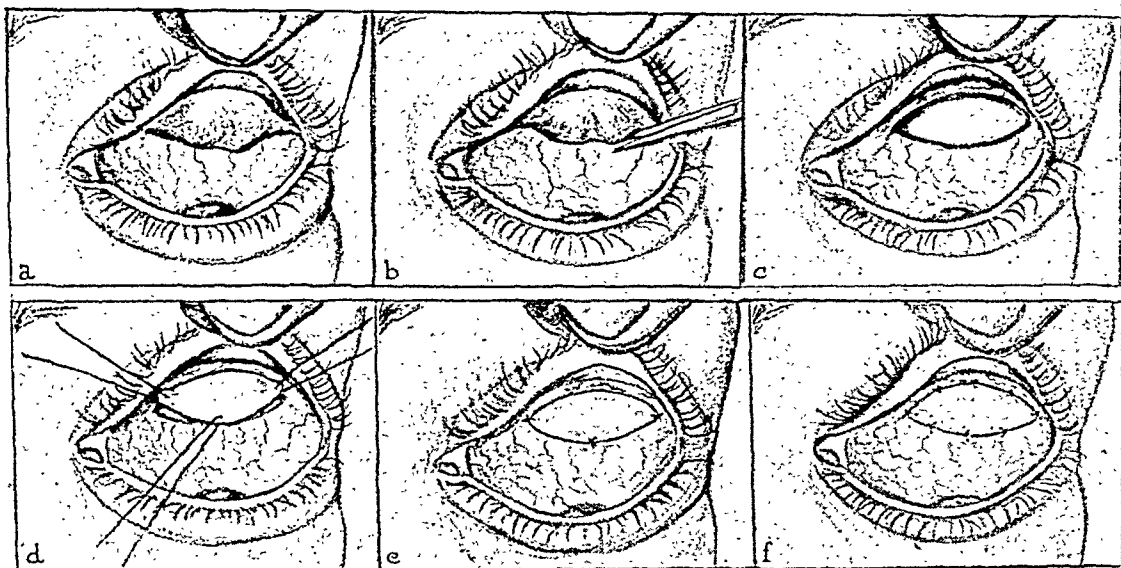


Fig. 3 (Rosen). Steps in the operative procedure. a, Adhesion of tarsus to eyeball. b, Adhesion is severed with scissors. c, Oval defect resulting from retraction of the adhesion. d, Donor's conjunctiva placed in defect left after separation of adhesion. e, Conjunctiva sutured in place. f, Appearance of eye upon completion of operation.

hemorrhage had become absorbed, and there was little indication of the point of attachment of the graft. Five weeks after the transplantation the flap had thinned out, leaving no marked elevation nor scar formation at the site of union of donor's and recipient's conjunctiva. At about this time it became apparent that not only was the transplant successfully adherent but the vascularization and corneal scarification were less marked. The patient thought that he was able to perceive light better than he had prior to the transplantation, although check-up showed that light projection was still faulty.

Although Filatov allows the sutures to remain only 24 hours, in our case they were kept in much longer. Von Hippel² had noticed that in many cases a clear corneal graft leads to a clearing of the surrounding leukoma, and upon the basis of these observations Filatov began to use his cadaver cornea, subsequently developing the new field of preserved tissue and its usage.^{3,4}

From this single case report it is conceivable that cadaver conjunctiva in refrigerated and unrefrigerated form may be used for a great many conditions.

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A CONTINUATION OF THE SCREEN TEST

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Ocular-muscle functions are, as a rule, considered "normal" when a state of so-called balance exists. Variations from the normal, or "imbalance," seem to have achieved classification more often by the extent of the variation than its nature.

"Normals" are not expressions of absolute values but of a vast average measure serving as a basis for comparison.

Discussion of one phase of this subject must take whole functions into account. Clinical proof of the functional value of separate muscles will be wanting because all other contributing actions cannot be rendered known or even constant while the single variable is investigated.

Successful treatment is based upon accuracy of diagnosis and the responsive properties of tissues.

In recent years the screen test has come into constant use because of its accuracy, simplicity, and objective nature. It enables the examiner to define the overactive or underactive eye as well as the particular system involved.

Perhaps the most common varieties of imbalances, influenced by refractive errors, are those of convergence and divergence.

Methods of measurement defining imbalances in these two directions are at variance in regard to terminology rather than actual meaning. Terms defining the nature of muscle action and the measure by which it is taken must be stated. Positions of rest, of fixation, of usual regard, and of maximum function are often loosely applied. Obviously they do not mean the same thing nor do any of these terms used separately and properly give

adequate information of imbalance in any given case.

The apparently simple action of convergence and divergence alone is really accomplished by a complex process of action involving all of the muscles. Some are concerned with primary action, some with synergetic action, and others with antagonistic action.

The method of testing ocular-muscle balance offered here was originated in an effort to extend the information given by the usual screen test and to define more specifically the underlying causes of lateral imbalances.

This method offers information with regard to convergence and divergence values and as to whether the anomaly is influenced largely by accommodation elements or is due to inherent inability of muscular response; it also indicates which eye is the greater offender. It shows, moreover, whether the convergence is normal, or if insufficient, whether the divergence faculties are excessive to render the convergence relatively underactive. One eye may tend to overconverge because its fellow does not turn in enough. If the deviating eye is always adjudged the faulty member and treatment is directed toward the reduction of its overactivity, the resultant might well provoke a semblance of balance by reducing the general operation of the complete system of action.

METHOD

The near point of binocular convergence (PpC) is determined and recorded in the usual way.

The patient is now required to fixate the test object, a tiny bulb flash light, brought slowly toward the bridge of the

nose *past* the point previously determined for PpC. This is called the "Light convergence test" and is referred to as the L. C. test.

The normal responses to the L. C. test are that: 1. Both eyes continue to converge maximally when the light has been approached closer than the previously noted PpC and even up to the bridge of the nose, or 2. Most usually, both eyes cease to converge at the same time and hold this position even though the light is continued in its approach, or 3. Both eyes diverge slowly and *equally* to the global midline or very slightly beyond, but to the *same* extent, even though the light is continued in its approach past the break point.

These responses have been noted if the muscles are in balance by other usual tests.

In cases of imbalance a point of approach of the light will be reached where *one* eye will cease to converge and proceed to rapid divergence to the global mid-line or beyond while its fellow continues to hold in the converged position or even continues to converge still more.

The underacting internus of the diverging eye is not yet incriminated as the chief offender, nor is this action always in agreement or compatible with the results of other muscle tests. This is only a step toward evaluation of the contributing muscles in convergence activity.

Conversely, an apparently overacting internus, as defined by other muscle tests, may show underaction by the L. C. test.

In order to reconcile these differences another test was devised known as the "Monocular convergence test," referred to as the M. C. test. The L. C. and M. C. tests complement each other.

The M. C. test is based upon the observation of Donders, well over 100 years ago, that when one eye was screened and a minus lens placed before the free eye,

the screened eye turned inward. The minus lens before the free eye induces increased accommodative effort, thereby increasing the convergence.

In Donders's experiment the station of the test object was fixed and the minus lens strength before the free eye was increased.

The M. C. test reverses this procedure in that the test-object distance is varied and the lens strength is maintained constant while the reaction of the screened eye is being observed.

Before any lens is placed before the free eye the test is performed in this sequence:

One eye is screened and its responses noted as the light progressively approaches, just as in the L. C. test. Normally the screened eye will diverge to the global mid-line when the test light reaches a certain proximity. If, however, the screened eye diverges past the global mid-line, and when the test light is still quite remote, a minus lens of known strength is placed before the free eye in the effort to restrict the screened eye from diverging beyond the global mid-line. The lens strength is progressively increased until the screened eye stops its divergence when the global mid-line is reached. The strength of the minus lens before the free eye, which is just sufficient in amount to induce the screened eye to hold to the global mid-line, is taken as the measure of accommodative stimulus necessary to maintain normal convergence.

Each eye is tested in the same manner and comparison is then made of the strength of minus lens necessary to limit the screened-eye divergence to the global mid-line area. It must be remembered that the screened eye is the one under test in its failure to converge normally, and that the minus-lens strength is the measure of the accommodative contribution to convergence.

If the PpC tests are within normal limits and the near screen test possibly shows esotropia, but the L. C. and M. C. tests show convergence insufficiency, the accommodation is functioning normally within the usual work distance (up to PpC limits) and the fault lies inherently in the convergence muscle structure.

If the PpA is greater than normal and the PpC is low (remote) there usually is an accommodative spasm (increased tonus) to stimulate the low PpC to better effort. The accommodative effort must be greater to stimulate the underacting convergence. For hyperopic persons, the use of a high or full plus correction to bring the accommodative effort to normal for age and decentering the plus lens in to give base-in prism effect, helps the underacting convergence.

In convergence squint or dominance, the M. C. test will probably show that the convergence muscles give a normal response. However, the overconvergence may be responsive to overstimulation in order to counteract an actual divergence-excess tendency. The spontaneous convergence picture binocularly is a symptom rather than a condition. Any treatment designed to lessen the overactive convergence or excess is misconceived if the primary fault is not in the convergence mechanism.

The binocular-test arrangement seems to be the factor that brings out the deviations, for, observed under occlusion cover with correction in place, the dominant eye is most usually straight or follows the direction of gaze of the fellow eye.

Treatment must be directed toward the creation or reestablishment of usual balance by such means as will stimulate an underacting system to greater responsive actions. Treatment directed at minimizing overactive mechanisms of functional order may produce a semblance

of balance merely by reducing the general operation of the complete system of action. Exception to this is in order where stimulation of underaction is subject to mechanical limitations to the extent that balance cannot be effected otherwise.

Merely reducing activity, or understimulating a normal function, is not cogent to a concept of treatment except by "weakening." Reducing convergence excess by high plus lenses, or radically by surgical recession, is not by any means "weakening" a muscle. The true response to such treatment is underaction physiologically, or mechanically, through leverage. Conversely, imposing a minus lens, or resection for divergence tendencies or conditions, does not strengthen a muscle, but merely gives greater advantage to the part in its usual process of function.

Symptoms in muscular anomalies are not proportionate to the amount of variation from the normal. Smaller errors cause a variety of troublesome symptoms while large errors often occasion but little discomfort.

SUMMARY

A method is offered as a continuation of the usually performed screen test, which aids in defining the offending mechanism in conditions of variation from accepted normal balance.

Used with other muscle tests for near, these tests afford information regarding the values of the most important contributors in the combined function of vergence.

The objective nature of the tests permit use upon the uncoöperative patient as well as the very young.

Defining the mechanism to which treatment should be directed offers a safeguard against inducing anomalies of opposite nature, in the attempt to achieve balance.

Majestic Building (3).

NOTES, CASES, INSTRUMENTS

NOTE ON THE INCIDENCE OF CLINICALLY SIGNIFICANT ANISEIKONIA*

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Often it is asked, "How frequently does aniseikonia occur in the general population?" This question is as difficult to answer as would be similar questions regarding errors of refraction or heterophorias. Aniseikonia is as general as are the errors of refraction or the heterophorias, and similarly it can be measured in almost every individual.

The question must be rephrased so as to ask, "What is the frequency of *clinically significant aniseikonia*?"¹ One may say that an aniseikonic error is clinically significant if there is a difference of at least 0.75 percent between the ocular images, and if there are sufficiently severe symptoms associated with the use of the eyes which cannot be attributed to other causes. In such cases we believe that a correction for aniseikonia is warranted. The frequency of clinically significant aniseikonia in the general population is difficult to determine satisfactorily, and so far only estimates have been made, which vary widely.

In an effort to answer the question of the incidence of clinically significant aniseikonia, we are reporting upon the statistics gathered in the town of Hanover, New Hampshire, where the Dartmouth Eye Institute is located. This town, in many respects, offers a satisfactory sample of the population for such a statis-

tical study. It is not near any large city, where some inhabitants would go for eye care; it is a college town, and so a large proportion of its residents use their eyes strenuously, and most of the residents can afford good eye care. All the aniseikonic tests were made in one place and the data for a 15-year period are available. Although all inhabitants who had general

TABLE 1

DISTRIBUTION OF HANOVER RESIDENTS EXAMINED FOR ANISEIKONIA FROM 1929 TO 1943

Year	Patients		Training Subjects	
	No. Examined	No. Given Aniseikonic Corrections	No. Examined	No. Given Aniseikonic Corrections
1929	6	4	4	2
1930	6	2	3	1
1931	11	3	1	1
1932	14	10	2	1
1933	8	3	0	0
1934	21	11	8	3
1935	33	17	10	4
1936	94	42	4	1
1937	37	16	10	4
1938	35	12	11	2
1939	15	5	5	2
1940	10	2	16	1
1941	15	3	215	6
1942	8	4	79	2
1943	7	1	11	1
Totals	320	135	379	31

eye care were not seen at the Institute†, a large proportion of them were examined here. Obviously, Hanover is not typical of rural or industrial communities. Furthermore, since the work originated here, the community is probably more conscious of aniseikonia than would be the people of some other town.

† Until the onset of the war the local clinic (Hitchcock Clinic) had one eye specialist who provided general eye care for a large number of Hanover residents. Also, a few of the residents undoubtedly consulted optometrists in neighboring towns.

* From the Clinical Division of the Dartmouth Eye Institute, Dartmouth Medical School.

This report of aniseikonic examinations pertains only to the permanent residents of the town and does not include any of the college students. Two groups of patients must be distinguished in the study: those who came to the Institute at their own initiative because of ocular symptoms, and those who volunteered as subjects in the training courses for aniseikonic clinicians. The majority of the latter group had no symptoms.

From 1929 through 1943, 699 Hanover residents were examined for aniseikonia. The number examined in the two groups, as well as the number for whom aniseikonic corrections were prescribed is given in table 1. The population of the town has been taken as 3,234, which is an average of the population figures given by the United States Census for the years 1930 and 1940. This figure includes about 700 children, of whom very few were examined for aniseikonia.

Thus, 699 Hanover residents, or about 21 percent of the population, were given aniseikonic tests. Of these, 320, or 10 percent of the population, were regular aniseikonic patients; while 379, or 11 percent, were subjects used in the training courses. Of the regular patients, 135 were given aniseikonic corrections. This represents 42 percent of the patients examined, or about 4 percent of the total population. Of the subjects used for practice and demonstration in the training courses, only 31, or 8 percent, were given aniseikonic corrections; and this is about 1 percent of the total population. Thus, 166, or about 24 percent of the 699 persons examined, were given aniseikonic corrections. The 166 individuals given aniseikonic corrections represent about 5 percent of the population of the town.

A recent study² of the results obtained with 2,115 patients given aniseikonic corrections indicates that about 70 percent

of the patients experienced complete or partial relief of their symptoms. This is in good agreement with the figures published by several previous observers.³ If in the classification of *clinically significant aniseikonia* we include only those patients whose symptoms were relieved by aniseikonic correction, the percentage of the population of Hanover having clinically significant aniseikonia is 3.5 percent (70 percent of the 5 percent of the population who were given aniseikonic corrections).

Summary and Conclusions. In an attempt to answer the question of the incidence of aniseikonia, a study has been made of the clinical data in the town of Hanover, New Hampshire. The results were as follows:

Average population, 1930-1940—3,234.

Total number of residents examined—699, or 21 percent of the population.

Number of regular patients examined—320, or 10 percent of the population.

Total number given aniseikonic corrections—166, or 5 percent of the population.

Estimated number of patients benefiting from the aniseikonic corrections—116, or 3.5 percent of the population.

These figures may not be representative of other communities, and the improvement in the technique of measuring aniseikonia, the simplification in instrumentation, the reduction in examination time and in the cost of aniseikonic lenses may bring about less conservatism in the examination for, and the prescribing of, aniseikonic corrections. Post⁴ stated: "Thus the aniseikonic clinics have become the rendezvous of the most difficult patients for whom to obtain comfort. That anything good is accomplished for these patients is the miracle." He recommended that the tests for aniseikonia be simplified so that the examination time could be

shortened, and also advised that the cost of the lenses be reduced. These are the current aims of the Dartmouth Eye Institute, and it is hoped that once they are realized the incidence of clinically significant aniseikonia will be studied again.

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SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

January 8, 1945

DR. MILTON L. BERLINER, *presiding*

DARK VIOLET LIGHT FOR MICROSCOPIC INSPECTION AND PHOTOGRAPHY

DR. ERNEST METZGER has been using this method as a diagnostic aid since 1924. It is applied with or without a fluorescein solution. He demonstrated the normal fluorescence of the clear lens and the appearance of pigment and fat in the anterior segment of the eye. He also presented stereoscopic photographs of the eye taken with this light.

CAMPIMETRY WITH ULTRA-VIOLET LIGHT

DR. GEORGE KLEEFELD demonstrated visual-field testing with ultra-violet light. In campimetry, and especially stereocampimetry, fluorescent targets together with fluorescent markings on the posterior surface of the perimetric arc permit the determination of the fields of vision in darkness. The delimitation of the blind spot is unusually accurate by this technique.

VISUAL EXERCISES IN OPHTHALMOLOGY

DR. JOSEPH I. PASCAL presented a paper on this subject. His theme was that visual exercises, using the term in the broadest sense, are bound to form a larger part of ophthalmologic practice in the future than at present. Starting with exercises to improve the visual acuity in an amblyopic eye, he stressed the fact that the resulting improvement is largely due to the psychic phase of vision. The process of training is largely educational,

teaching the mind to make better responses. An extension of this procedure is to teach the mind to appreciate better nonfocused retinal images. This can be done to a certain extent, although the procedure is overexploited by some non-medical practitioners. The principles underlying these exercises involved the application of movement, color, and some bodily activity.

He spoke of exercises for (1) the improvement of peripheral vision and its importance; (2) improving color perception in the light of established facts; (3) improving the rate of reading; and (4) improving the speed and span of the visual act. The latter is in line with the modern psychological concept, the so-called "Gestalt psychology" which postulates that we learn by "synthesis" rather than by "analysis."

Dr. Pascal then reviewed the exercises for improving neuromuscular coordination of the eyes in the act of binocular vision. He mentioned the red-glass test as a means of judging whether or not any neuromuscular incoordination requires immediate attention or not. For these exercises he stressed the fact that they can be given without elaborate apparatus, if need be. Simple prisms will provide rhythmic or sustained exercises, sometimes by means of the step method, sometimes the sliding method, or a combination of these. Variety and interest are all important. In addition, even the use of a simple stereoscope will help greatly, especially if it is used with the Pointer method, which, he said, he described some 12 years ago.

As not many ophthalmologists may be fitted by temperament to engage in this

work directly, since it is largely in the nature of teaching, Dr. Pascal suggested the employment of trained orthoptic technicians. These technicians are usually women, have more tact and patience for teaching elementary skills and are most suitable to administer these various exercises under the supervision of the doctor.

Discussion. Dr. James W. Smith asked for more information regarding exercises in color-blind patients. Men, rejected for military service for this reason, inquired about a clinic in Brooklyn which could cure their defect. An editorial in the J.A.M.A. of June 5, 1943, stated that the claim of the optometrist Lepper of an alleged cure for color blindness was unwarranted and that he was conducting an educational rather than a therapeutic process. An intelligent patient can memorize the plates used in the Ishihara test. One color-blind patient seen by Dr. Smith even trained himself to give the correct answers for the pseudo-isochromatic plates if they were presented to him in regular sequence. However, if half of the plate was blocked out or turned upside down, the patient's answers were again those of a color-blind individual. Dr. Pascal has been discussing temporary color retraining rather than visual exercises.

Dr. Daniel Rolett acknowledged the importance of visual training in the amblyopias or for poor development of the visual sense or reading ability. However, a patient of his, rejected by the Merchant Marine because of color blindness, attended a private clinic in Brooklyn to cure this defect and then applied for admission to the Marines where he was accepted. He returned to see Dr. Pascal, who presented to him the Ishihara test, all numbers of which he read easily. However, when shown an old set of German

plates he was unable to read them and admitted having memorized the Ishihara chart. Another patient went through this same "training" with the same effect.

Dr. Morris Jaffe said he considered the retraining of diminished visual acuity and defects of color perception fraught with dangerous possibilities. He described a patient with primary optic atrophy associated with cerebrospinal syphilis. The patient and his wife were informed of the poor prognosis and were advised that he should learn Braille and have occupational training to become self-supporting. Instead, Christian Science healing was undertaken. Six months later, when the patient was reexamined the findings were unchanged, but he and his wife were certain that his vision was restored and proved the point by telling exactly the time on a clock on a bookcase. However, when the hands of the clock were pushed back a half hour, he could not tell the changed time, nor could he count fingers at 12 inches. The patient had adjusted himself to his condition, but still could not see the physical world about him. He later admitted he would be happier if he could learn some useful work.

The psychologic approach of reeducation to enhance visual and color perception will only stimulate charlatanism from those who have no adequate specialized medical training in the field of ophthalmology. This therapeutic aid, as suggested by Dr. Pascal, must be received with caution and critical judgment.

Dr. Pascal concluded by stating that he had not done much work in the field of retraining of color vision but has been in correspondence with people who have and for whose honesty he can vouch. They have obtained results not explained solely by memorizing. Many of their patients have acquired a system of recognizing colors, probably in some other manner.

The methods vary with different men. One merely has to impress upon an individual a certain color. One method, as a starter, is to show the individual three primary colors in bright saturated discs and let him look at them intently until he can recognize each of them by name. The training cards are then reduced in size and brightness and some explanation of "shades" and "tints" is introduced. There is more to this process than memory.

Dr. Pascal said he had no experience with the use of vitamin A in color rehabilitation, but greatly doubts its efficacy except where there is a general systemic lack of vitamin A.

Regarding improvement of visual acuity by training, the case of an 18-year-old girl was described. She had been given exercises in order that she might stop wearing glasses which were given her at the age of 9 years and which she managed to do without most of the time. On the Snellen chart the uncorrected vision was between 20/30 and 20/40. Objective examination indicated about 2 diopters of myopia and subjectively, on unfamiliar picture charts, the visual acuity corresponded to the refractive error. Nevertheless, she read 20/30 to 20/40 on the conventional charts. Her sight for things about the room was definitely better than that of a person with 2 diopters of myopia who regularly wears glasses and then removes them. In other words, this was an individual who disliked wearing eyeglasses, wore them only occasionally, and consequently trained herself to see fairly well without glasses even before she went to this practitioner for special aid.

Dr. Pascal agreed that charlatanism is indeed a problem and that this field, like all new fields, is apt to be exploited. It is therefore important for ophthalmologists to investigate it and adopt whatever is of benefit in their work.

PRACTICAL POINTS IN PRESCRIBING BIFOCALS

DR. ARTHUR LINKSZ said that comfortable near vision through bifocals depends on more than proper refraction and the choice of an adequate reading addition. Habits, occupation, and number of optical and mechanical factors must be taken into consideration. The optical properties of some bifocals were described and it was pointed out that Benjamin Franklin's original bifocal, although cosmetically undesirable, is at the same time optically one of the best types yet devised. The prismatic effect, because two separate lenses are used, is very low and there is no distortion nor color difficulty in the reading portion.

One of the most widely used bifocals today is the one-piece variety. The so-called "A" one-piece bifocal is an excellent lens and may be used with strong plus lenses and with weak additions; the optical center of the reading portion is about 8 mm. below the distance center. When a minus lens is worn, there is a great base-down prismatic effect with this bifocal, and on looking through the lower portion the floor seems far higher than it should. In these cases a "B"-type segment is called for, and this, with its small radius of curvature, and higher center of curvature, will minimize the displacement. Formulas were presented for making the various calculations regarding these lenses, their size, and the location of their optical centers.

Discussion. Dr. Joseph I. Pascal pointed out that the Franklin bifocal is a single-center lens, the two components being divided along the optical centers, which are placed adjacent to each other. The idea of having the optical center of the upper part 4 mm. above the dividing line, and the optical center of the lower part 4 mm. below the dividing line came in

long after Franklin's death. The latter bifocal is a bicentric bifocal, whereas the original Franklin lens was monocentric. Probably if Franklin had invented a bifocal lens with two optical centers, bifocals would not have been so rapidly adopted. The important point is that his lens had only one optical center, so that the image of any object was always formed along one axis. This is the real point, image formation along one principal or secondary axis. Dr. Linksz discussed only one type of bifocals, probably for lack of time, but there are, of course, many other types, fused bifocals, and so forth.

Dr. Linksz agreed that the original Franklin bifocal had only one optical center but had not discussed the lens because of time limitations. He emphasized that this two-piece type of bifocal can be made with two optical centers, each in its proper place and so be free of prismatic effects. The so-called "jump" caused by bifocals with two optical centers instead of one, is no disadvantage, and in fact is never noticed by the patient, as the eye does not register while moving over the dividing line. The original Franklin bifocal with one optical center, while free of "jump" has a prismatic effect both at the far and reading points. Bifocals should be constructed so as to have optimum optical properties 4 to 6 mm. above and below the dividing line. While there was no time to discuss fused bifocals, the various mathematical considerations presented are valid both for the fused and one-piece types.

EXAMINATION AND CORRECTION OF ASTIGMATISM

DR. I. S. TASSMAN said the examination should commence with an accurate history and a careful analysis of the complaints with consideration of the subjective symptoms, age, and occupation; then

these factors should be evaluated as to their connection with a possible refractive error. Headaches should be studied: their situation; whether they appear during the day, especially while the patient is at work or at school. Panoramic headache should make the examiner consider asthenopia. When determining the visual acuity, note which letters are correctly called and which are miscalled; these give an indication as to the type of refractive error.

In all cases with active accommodation a cycloplegic should be used. Atropine, 1-percent solution, and paredrine, 1-percent solution, are used for children; after 13 years of age, homatropine, 2-percent, and paredrine, 1-percent, are used. In performing the retinoscopy, examine the central area by having the patient gaze at the light; children should keep their heads straight. Neutralize first one principal meridian to convert the error to simple astigmatism and then use a cylinder to neutralize the remaining band of light. A subjective examination should follow the objective test. All cases in which a cycloplegia is used should have a post-cycloplegic examination, at which time the strength of the sphere may change; the strength and axis of the cylinder is not frequently changed. The use of a cross cylinder is helpful in accurately determining the axis.

If an older patient is receiving his first cylindrical correction, when the latter is of a high degree it may have to be reduced; children are given the full strength. The fitting is important, especially for high cylinders, oblique axes, and for the presbyopic subject wearing bifocals.

Discussion. Dr. J. H. Bailey disagreed with the claim that the combination of paredrine and homatropine produces greater cycloplegia than homatropine alone. He believes that under like condi-

tions the cycloplegia produced by 5-per-cent homatropine solution is not increased by the addition of paredrine.

Paredrine is a sympathomimetic drug, and, as such, must be an exciter or an inhibitor of certain smooth muscles. It is asserted that paredrine acts upon the ciliary muscle in a manner analogous to its action on the dilator pupillae, which, in turn, postulates a dual innervation of the ciliary muscle, sympathetic longitudinal fibers (Bruecke's muscle), and antagonistic parasympathetic circular fibers (Muel-ler's muscle). The longitudinal component supposedly causes flattening of the lens, rendering the eye hypermetropic whereas the circular component increases the curvature of the lens, adapting the eye for near vision.

In the first place sympathetic fibers going to the longitudinal muscle cells have not been isolated or identified. Secondly, it is very much disputed that sympathetic excitation by stimulation of the cervical sympathetics results in a flattening of the lens. Furthermore, the word cycloplegia connotes a relaxation of the entire ciliary muscle and not one part contracted and the other part inhibited.

Static refraction means the refraction of the eye in repose. Obviously if paredrine excites a part of the ciliary muscle, the eye is not in repose from the standpoint of refraction. Furthermore, the procedure usually performed to determine the residual accommodation, which, in turn, is the measure of the adequacy of the cycloplegic, leaves much to be desired. The examiner should make an allowance for such factors as the mydriasis, the angle subtended by the test object, and the several psychologic variables. The ophthalmologist must also bear in mind that the extent of the cycloplegia is influenced by the nature of the vehicle containing the drug. Homatropine is usually

prescribed in a watery solution, while the combination of homatropine and paredrine is prescribed in a more favorable menstruum conducing to its greater concentration in the aqueous chamber and thus enhancing its effect.

Dr. J. I. Pascal agreed with Dr. Tassman in his insistence on accuracy and exactness in astigmatic corrections, provided the physiologic nature of the problem is not forgotten. In dealing with a living dynamic organ the degree of mathematical exactness must be commensurate with physiologic variations. Even if the astigmatism is corrected with theoretical precision, there are still intrinsic variabilities in the astigmatic correction which cannot be eliminated.

Dr. Tassman concluded by stating that paredrine is effective as a cycloplegic only when employed with homatropine and atropine, and does enhance their value. Paredrine is not of itself a cycloplegic and even homatropine has been said at times to be unsatisfactory when used alone. The innervation of the ciliary muscle is a large subject and one which is still discussed.

The refractionist should try to obtain a mental picture of the patient's condition, particularly with reference to the accommodation. There are, of course, several different ways of measuring the accommodation; this should be satisfactorily estimated and, if residual accommodation remains, its extent should be known and taken into consideration. There should be an attempt to determine the extent to which the symptoms are caused by the astigmatism present, by the activity of the accommodation, and the occupation of the patient. These three factors together with the age must all be considered in order to prescribe a correction which will provide the relief that the patient seeks.

USE OF MYODISC LENSES IN THE POST-OPERATIVE TREATMENT OF RETINAL DETACHMENT

DR. ERNST L. METZGER stated that the Lindner pinhole spectacle with its 3-to-5-mm. peephole results in a very limited visual field. The return of a patient who has been operated on for detachment to normal life is facilitated if, after he has worn the stenopeic spectacles, myodisc lenses with the smallest diameter available are used. They are less conspicuous than the stenopeic spectacles and prevent excess rotation of the eyes for a much longer period after the operation. The patient is more willing to wear them; some patients, in fact, do not return to the use of the usual lens at any time. To be effective, there should be a difference of from 6 to 10 diopters between the central corrected portion of the lens and the peripheral flat part. A hook-on addition is prescribed for the presbyopic patient.

Leon H. Ehrlich,
Secretary.

CHICAGO OPHTHALMOLOGICAL SOCIETY

January 15, 1945

DR. SAMUEL J. MEYER, *president*

FIRST ANNUAL SANFORD R. GIFFORD
MEMORIAL LECTURE

THE PATHOLOGIC PHYSIOLOGY OF CON-
VERGENT STRABISMUS

DR. FRANCIS HEED ADLER presented a
paper on this subject.

CLINICAL MEETING

(Given by the Department of Ophthal-
mology, Northwestern University)

CENTRAL MYOPIC DEGENERATION OR CEN-
TRAL RETINAL VASCULAR DISEASE

DR. HELEN HOLT said that Mrs. B. H.,

aged 50 years, had experienced sudden loss of vision in the right eye on November 23, 1944. No general symptoms were associated nor was there ocular pain. On December 14, 1944, when seen in the Clinic, the corrected vision was R.E. 10/200; L.E. 20/70. In 1941, with the same correction (R.E. -2.25D. sph. \approx +1.00D. cyl. ax. 155°; L.E. -12.00D. sph. \approx +2.00D. cyl. ax. 75°) the vision was R.E. 20/25-3, L.E. 20/40. At that time the right eye was normal and the left had a posterior staphyloma, myopic degeneration, chorioretinitis, and a stellate cataract on the surfaces of the adult nucleus.

On examination there was found a large retinal and preretinal hemorrhage in the macula of the right eye. During the following weeks this gradually cleared, leaving a gray elevated area in the macula, about 2 to 3 disc diameters in size, surrounded by a crescent-shaped hemorrhage. All tests for foci of infection were negative. Peripheral arteries showed Grade-II angiospasm. Chorioretinitis was ruled out, and the differential diagnosis between myopic central degeneration and central retinal angiospasm was considered. Since the changes occurred in the eye with the mild myopia, the first etiology seemed less likely. The elevation of the lesion with edema and peripheral angiospasm led to the choice of central retinal angiospasm or vascular disease as the etiology. Treatment with depromanex was continued, but the vision did not improve beyond 20/200.

POSSIBLE PARTIAL CLOSURE OF THE CENTRAL ARTERY

DR. HELEN HOLT said that Mr. P. P., aged 60 years, had been treated in the medical clinics for mild arteriosclerosis obliterans from August, 1944, until December 6, 1944, at which time he was ad-

mitted to the Eye Clinic. Twenty-four hours previously, while sitting, the vision of the left eye blotted out. There were no associated symptoms. Visual acuity was R.E. 20/25, L.E. 10/200. Blood pressure was 160/92.

External examination revealed no abnormalities, and both fundi appeared normal except for questionable narrowing of the arteries. Fields showed a 20- to 40-degree central scotoma in the left eye. Vasodilators, papaverine by mouth, and intravenous typhoid vaccine were administered, with no improvement in visual acuity or fields. On January 9th, very slight pallor of the disc of the left eye was observed, and a slight enlargement in the central scotoma was elicited. A diagnosis of partial occlusion of the central retinal artery of the left eye in an individual with early Group-I arteriosclerotic retinopathy was made.

DEEP TUBERCULOUS KERATITIS TREATED WITH BETA EMANATION

DR. HELEN HOLT said that Mrs. D. McQ., aged 31 years, suddenly complained of a foreign-body sensation in the right eye during a routine eye examination on September 30, 1944. No pathologic change was found. She returned on October 18th, when the eye was slightly injected and there was considerable photophobia. Corrected visual acuity had dropped from 20/25 to 20/40. Ciliary injection was present on the nasal side of the cornea and gray infiltrates extended into the cornea from the limbus for a distance of 2 mm. on this side. Folds in Descemet's membrane were numerous, but no vessels were present. A diagnosis of deep keratitis was made.

Wassermann and Kahn tests had been negative prior to two pregnancies; the last cesarean section was performed about 15 weeks prior to the onset of the eye symptoms. The tuberculin test was positive and

tuberculin therapy was instituted. Locally, atropine and heat were advised. The lesion progressed steadily until the entire cornea was gray, and all of Descemet's membrane was involved. The cornea remained avascular except for one deep vessel at the 3-o'clock position, extending in about 2 mm. Vision was reduced to perception of hand movements. On October 23d an X-ray treatment was given, and beta-emanation therapy on October 30th, November 6th and 27th. On November 21st definite improvement was noted, and the infiltrates gradually faded from the periphery inward. On January 8th only a small gray area above the center of the cornea remained, and the corrected visual acuity had returned to 20/25.

TUBERCULOUS KERATITIS

DR. BEULAH CUSHMAN presented Mrs. A. S., aged 34 years, who had been under antisyphilitic therapy. On September 16, 1944, she was referred for an eye examination because of pain and photophobia in the left eye. Vision was 20/50, corrected. A corneal ulcer was found superimposed on an old corneal scar which had been presumed to be interstitial keratitis. In spite of treatment with atropine, vitamins, and cauterization the area continued to break down, and fresh infiltrates persisted beneath Bowman's membrane. On October 13, 1944, a positive skin reaction to purified protein derivative was obtained and tuberculin therapy was instituted. This was continued, with gradual healing of the lesion. Ciliary injection and corneal vascularization disappeared and a gray nebular scar occupying the upper central portion of the cornea remained. The corrected visual acuity was 20/50+3.

Robert Von der Heydt.

COLLEGE OF PHYSICIANS OF PHILADELPHIA

SECTION ON OPHTHALMOLOGY

January 18, 1945

DR. WARREN S. REESE, *chairman*

ACQUIRED PTOSIS, CLASSIFICATION AND CORRECTION

DR. EDMUND B. SPAETH presented an analysis of over 200 patients in whom an acquired ptosis was either the sole complaint, or ptosis appeared as a part of the symptom complex of the underlying condition. From these cases a classification was developed based upon anatomic and etiologic characteristics. Instances of each subdivision were shown with lantern slides.

The varied surgical means for correcting these different conditions were presented. All forms of symptomatic ptosis are not surgical conditions. Those, however, which are such, need individual attention depending upon the underlying characteristics of the case under consideration. (See this Journal, October, 1945.)

Discussion. Dr. James S. Shipman said that Dr. Spaeth had shown a great number of cases of ptosis that many never thought occurred. Usually ptosis is considered a congenital condition which can be corrected by one of many different operations, and the reason that there are so many different operations for ptosis is that none of them are perfect.

Dr. Spaeth demonstrated that ptosis does occur after birth, due to many causes, and is not by any means always congenital. Before operating on any patient with ptosis, one should first determine whether or not the condition is congenital in origin. If it is a case of acquired ptosis, what is the reason for it? What is the pathology? Unless this investigation is made, difficulties may arise

that otherwise could be avoided. Certainly in ptosis due to syphilis or myasthenia gravis, one does not wish to try operative intervention. There are many pitfalls that one is liable to fall into by being too quick to operate for ptosis. Make sure first of the diagnosis as to the reason for ptosis, and, when that is decided, then with due consultation, plan a procedure that will relieve the ptosis. As Dr. Spaeth showed, the operative principle used in correcting acquired ptosis is very much the same as that used in correcting congenital ptosis. The cause, the scar tissue, and the pathologic change present, however, modify a great deal the technique that is to be followed.

Included in the cases presented by Dr. Spaeth were some which Dr. Shipman had referred to him. He particularly wished to mention the case of the woman who had a pachydermatocele. There was an enlarged eyelid that hung down on her cheek, and the eye protruded out to the cheek also. He said she had one of the worst looking eyes he had ever seen. When last examined she had a good socket, and a well-fitted artificial eye. He said he had assisted Dr. Spaeth in one stage of the operation in which the dura was uncovered in the roof of the orbit. This was a very difficult case to follow through, requiring a great deal of patience and skill, and more than the average amount of boldness to bring this woman's face to a normal appearance.

REVIEW CONCERNING ABERRATIONS OF THE EYE

DR. ALFRED COWAN said that Thomas Young, as early as 1801, showed conclusively that the eye was neither achromatic nor aplanatic. Many others, particularly Volkman, Donders, J. H. Knapp, and Tscherning, investigated the aberrations of the eye; but the most thorough study of the actual image of the eye was made

by Gullstrand. He found that the caustic surface is extremely intricate, and that it varies as the meridian section is revolved around the axis.

In the eye there are not only all the aberrations which must be eliminated in a well-designed artificial optical instrument, but the added faults that exist in a living asymmetric organ.

The aberrations of the eye are physiologic, and their absence would be of no use for the eye. The effect of the circle of least confusion is that of a point image as long as its diameter does not exceed the revolving power of the eye. The retina is sensitive to distinct visual acuity only in a very small area at the fovea, and for this reason only that part of the caustic which is found most useful is utilized. The surrounding halo is disregarded. Also, because of the peculiar structure of the retina, the effects of marginal astigmatism, curvature of field, distortion, and so forth, are negligible. The faults of the optic system of the eye do not interfere with distinct visual acuity.

Discussion. Dr. Francis Heed Adler said that this paper indicated fair-mindedness in at least one physiologic optician. The majority seem to have such faith in geometric optics that they are like an economist who willfully blinds himself to the frailties of human nature in order to believe wholeheartedly in the doctrines of Karl Marx. They insist on speaking of point image on the retina, although they know they do not exist. This has seriously retarded the knowledge of visual physiology, and Dr. Lancaster is quite right in emphasizing the importance of learning about image formation in the eye as it occurs in nature, and not as it is pictured in geometric optics. He agreed with Dr. Cowan that geometric optics should be taught as the basis for physiologic optics, but the student must be carried beyond this, and instructed in image formation

as it actually occurs in the human eye.

Dr. I. S. Tassman commended Dr. Cowan for pointing out the benefit of retinoscopy in at least obtaining an approximate determination of the refractive state.

It seemed to him that in recent years there had been a tendency to, perhaps, overemphasize subjective examination in refraction, or at least to emphasize certain subjective tests and methods for determining the result in refraction. At the same time, in a great many instances, the objective examination is neglected. He said that a paper of this kind would help to overcome some of the objections that have been advanced about objective examination and retinoscopy, particularly in those cases in which cycloplegics are employed. One of the chief objections to the use of cycloplegics has been said to be the very large pupil, and the difficulty in making a retinoscopic examination of the central area.

This, as Dr. Cowan pointed out, should not present any difficulty to one with any experience at all in retinoscopy. He said that he would add that retinoscopy should be performed in every case preliminary to subjective examination regardless of whether a cycloplegic has been employed or not. He said it is a mistake in the examination of the presbyopic especially, to omit retinoscopy.

INFECTION OF THE HUMAN EYE WITH TORULA HISTOLYTICA

DR. CHARLES WEISS, DR. M. C. SHEV-
KY, and DR. I. H. PERRY said that through the coöperation of Dr. Martin I. Cohen of San Francisco, they examined material obtained by trephining the sclera of a patient in whom the clinical diagnosis of a possible cyst of the retina had been made. The following history was given:

Mr. A., aged 56 years, had been in an automobile accident in 1941. In July,

1943, Dr. Nutting of Oakland, California, discovered a growth in his right eye, and enucleated the eye in October, 1943. Three months later the patient complained of poor vision in the left eye. He soon developed mental symptoms, and was confined in a sanitarium. The eye showed fine deposits on the posterior surface of the cornea, and on the anterior surface of the lens. There were "floaters" in the aqueous and vitreous. A diagnosis was made of "possible cyst of the retina with retinal detachment and uveitis." The sclera was trephined, and material obtained for culture showed the presence of a yeastlike organism which was identified as *Torula histolytica* (*Cryptococcus hominis*). This was the second case in the literature of an ocular infection due to *Torula histolytica*.

In its cultural characteristics the organism resembled Benham and Hopkins's *Torula* Group III when grown in cornmeal agar. Its ability to ferment carbohydrates was weak and variable. No gas was formed. Gelatin was not liquefied. There was abundant budding, but neither mycelia nor endospores were formed. The organism killed mice when injected intraperitoneally or intravenously.

When the culture was injected into the anterior chamber of the eyes of rabbits, it was possible to observe very early pathologic changes. The inferior part of the anterior chamber became opaque, and a pannus developed on the surface of the cornea.

Histologically there was a slight exudate consisting of polymorphonuclears and some monocytes along the periphery of the cornea. Along the anterior surface of the iris and the posterior surface of the cornea, there was a delicate festoon of rosettes. In the center of each rosette, there was a *Torula* organism surrounded by a single row of cells (polymorphonuclears and monocytes). *Torula* were seen engulfed within macrophages.

Discussion. Dr. William O. LaMotte, Jr., said that this organism known as *Torula histolytica* was brought to the attention of the Eye Department of the University Hospital during the past year through the opportunity of observing the eyegrounds of a patient on the Orthopedic Pediatric services who subsequently died of a *Torula histolytic* infection of such widespread degree that the term torulosis could aptly be applied to it. A report of this case will be published by Dr. Joseph Snyder, the resident pathologist at the University Hospital. This six-year-old girl was originally admitted for penicillin therapy of a chronic osteomyelitis in the left femur and right humerus. The offending organism was hemolytic *Staphylococcus aureus*. It was not long after admission that signs of a generalized systemic infection and involvement of the central nervous system appeared, including an increase in the cerebrospinal-fluid pressure. Many *Torula* organisms were isolated from the spinal fluid both by direct smear and culture. Despite massive doses of penicillin, intramuscularly and intrathecally, the child died. The penicillin therapy did not influence the number of organisms found in the spinal fluid. It was about six weeks after the first sign of the central nervous involvement that the child died. During all this time, she was kept under observation so far as the fundus was concerned. There were no definite changes until a week before death, at which time a bilateral papilledema of 2 to 3 diopters appeared. Also, in the region of the posterior pole of each eye, there were seen a number of poorly defined, pale yellow areas about one-eighth disc diameter in size, and deep to the retinal vessels, having somewhat the appearance of deep necrosis or deep exudates.

At the autopsy the orbits were unroofed, and the posterior segments of the

eyes were removed. In view of the fact that this *Torula* organism was found histologically in practically every tissue of the body, it was thought that perhaps the finding of *Torula* might explain these patches that were observed ophthalmoscopically in the eye before death. Sections did show in the retina a few nests of *Torula histolytica*, although not in so great abundance as was expected, judging from the lesions seen ophthalmoscopically.

This case, and the subject of *Torula*, brings up several interesting points. One is the fact that some authorities, and it is believed that Dr. W. Freeman and Dr. Fred Weidman are probably the principal ones, believe that the term *histolytica* is a misnomer, and in their experiments have shown that the organism is not actually histolytic for nervous tissue. Some of the brain sections from this case showed typical cystic areas containing *Torula* surrounded by brain tissue which had a compressed appearance. This in a sense might uphold the thought that the typical appearance is due to a disruptive rather than to a destructive process from the actual growth of the organism.

The portal of entry has always been a problem, and it has not been solved in this nor any other case. In this particular case, one would naturally expect that it might be the draining sinuses in the infected bones. However, at no time was anything

but hemolytic *Staphylococcus aureus* obtained by culture from these lesions, although *Torula* were found in abundance histologically in the bone marrow as elsewhere.

Another point is that in all the articles that have appeared, and also in the recent one by Dr. Martin Cohen (*Archives of Ophthalmology*, December, 1944), the statement is made that this organism, genus *Torula*, occurs widespread in nature. He said he understood from Dr. Weidman, however, that an organism which can produce infection in the human or in an animal has not been found in nature; that these organisms of this group found widespread are all saprophytic, and that he considered it still a problem as to where this particular organism that causes human infection resides in between these relatively infrequently reported cases. He asked if, in his experiments, Dr. Weiss had used only the organism isolated from his case, or if he had actually attempted to produce animal infection with some of these organisms which had been found from this widespread source in nature.

Dr. Charles Weiss, in reply, said that only the strain which was isolated from the patient was used to produce the lesions in the rabbit's eye.

George F. J. Kelly,
Clerk.

AMERICAN JOURNAL OF OPHTHALMOLOGY

Published Monthly by the Ophthalmic Publishing Company

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PROBLEMS OF POSTWAR OPHTHALMALOGIC TRAINING

It is unfortunate that so many good ophthalmologists were not used to better advantage in the Armed Forces. To some extent this was unavoidable, since the age group of the service personnel largely excluded glaucoma, senile cataract, and the degenerative diseases. This fact, together with the mass of paper work, the annoying details of maintaining military discipline, or the enforced periods of com-

plete inactivity, has made the average ophthalmologist feel that his time in the Army or Navy was more or less wasted, as far as scientific medicine was concerned. There are exceptions, of course, but a large proportion of them now returning to civilian life feel this way. These men have a sense of insecurity about reëntering the competition of private practice, and more and more of them are demanding refresher courses. It seems only right that their desires should be gratified.

In addition to this, many young medical officers who were denied the opportunity of taking a residency in ophthalmology, now wish to begin one. Based on replies received to questionnaires, the council on Postwar Medical Service of the A.M.A. has recommended that every approved ophthalmologic residency in the country increase the number of its house officers by 90 percent to accommodate this demand!

We are therefore faced with a problem of "reconversion" in ophthalmic education quite as serious as that which confronts industry.

In the editorial columns of the September, 1945, issue of this Journal, Post pointed out the need for every medical school and hospital to stretch its facilities to the utmost to provide places for these homecoming physicians. To take care of all of them would put too much strain on the already depleted facilities of these institutions and so impair the quality of the teaching that the expected benefits would not be realized. Every teaching center must, therefore, do the best it can in view of its resources and capabilities, keeping in mind that it is better to give good teaching to a few than poor teaching to many.

To help meet the demand for short periods of refresher work the Department of Ophthalmology of Harvard Medical School is planning to give two postgraduate courses early in 1946. The first course will last two months and will be devoted entirely to the fundamental sciences in ophthalmology. The subjects covered will be anatomy, histology, and embryology of the eye, bacteriology, physiology, pharmacology, and toxicology of the eye, neurology of the visual and ocular-motor pathways, and physiologic optics. Laboratory and experimental work will be included to illustrate the didactic exercises. This course is designed pri-

marily for young doctors who wish to enter ophthalmology as a preliminary to beginning their residency. It is hoped that it will also prove beneficial to older ophthalmologists who feel the need for review and reorientation.

This course will be followed immediately by a one-month course in clinical ophthalmology. In this, all aspects of the clinical and pathologic work at the Massachusetts Eye and Ear Infirmary will be dealt with, and the recent advances emphasized. This latter course is open only to ophthalmologists who have had a recognized ophthalmic residency and to other physicians who have completed the first course in the fundamental sciences, or its equivalent elsewhere.

A maximum of 30 veterans can be accommodated in each course. The major part of the tuition will be borne by the government under the G.I. Bill of Rights.

The above is illustrative of a short period of training. Other medical schools are planning to give longer courses of six to nine months for those veterans who desire them.

In regard to the feasibility of increasing the number of residencies, certain difficulties arise. Although the financial responsibility of the government is clear in regard to organized postgraduate courses conducted by a paid faculty in an established medical school, there has been no definition of policy concerning residencies for which no tuition fee is charged. The cost of maintaining a house officer (room, board, and laundry) amounts to about \$500 a year in the larger institutions. The addition of five or six extra residents for a two-year period would represent an added expense that many institutions might not care to assume. So far, this writer has not been able to obtain assurances from the Veterans Bureau that this maintenance charge will be paid by the government.

In fact, present instructions from Washington definitely state that payment for board, lodging, or other living expenses is prohibited. However, the Veterans Administration will pay to the veteran himself the usual \$50 a month (\$75 in case of a married man) for subsistence during his residency. There is some reason to believe that these amounts will be increased in the near future. Extra residencies must be created even though the housing problem in some hospitals may necessitate the veteran's living outside and paying for his own room. Such arrangements may seem niggardly in view of the sacrifices most of these men have made, but the housing situation may prove to be a formidable one if any substantial increase of residents is attempted.

Each institution will have to work out its own problem. It is hoped that each will do its utmost to help train these returning medical officers. The type of ophthalmologic care the American public is going to receive during the next 10 years depends, to a large extent, upon our willingness to participate in this training program.

Edwin B. Dunphy.

THE LOS ANGELES MID-WINTER POSTGRADUATE COURSE

The fifteenth annual mid-winter postgraduate course of the Los Angeles Research Study Club was held from January 21st to February 1st, inclusive. It has been the endeavor of those in charge to make the course essentially practical; to have "ideas presented that may be taken home to be utilized in everyday practice" and to stimulate the interest in "research study." This year the first week was devoted to the eye. Over 300 registered for the ophthalmologic portion of the course; in this registration 27 states and British Columbia were represented.

Dr. Alan C. Woods of the Wilmer Institute discussed the various phases of ocular tuberculosis; management, diagnosis, and treatment of uveitis; sarcoid; Brucellosis; the ocular complications of congenital and acquired syphilis; sympathetic ophthalmia, and the role of focal infection. Dr. Jack S. Guyton, also of the Wilmer Institute, discussed the various operative procedures used in ophthalmology together with a new operation for orbital decompression. Dr. Meyer Wiener presented the Naval ophthalmic problem and gave an instruction course on major surgical procedures. Diagnosis and differential diagnostic problems of glaucoma, congenital cataracts, and ocular therapeutics were discussed by Dr. Frederick C. Cordes of San Francisco. Irving B. Lueck of Rochester, New York, presented various aspects of physiologic optics together with a discussion of color aptitudes and the new antireflection coating of ophthalmic lenses. In addition there was a discussion of the everyday spectacle problems. From the titles mentioned it is apparent that the program was varied and essentially practical.

It is noteworthy that in spite of the hardships, difficulties, and limitations placed upon it the course was able to continue its annual meetings during the war and to contribute to the war effort by making it possible for the busy and often overworked civilian ophthalmologist to keep abreast of the newer developments during that trying time.

While many of those registered attended the course last year, it was apparent that this year a high percentage were newly discharged veterans or men still in the service. For many it was the first real contact with civilian ophthalmology for a number of years; they had, in some instances, been stationed in areas or on posts where there was little or no ophthalmology, while others were in execu-

tive positions where there was no contact with clinical medicine. The attentive attendance at the lectures from 9:00 in the morning until 5:30 in the afternoon and the interest in the informal discussions over a cocktail or a glass of beer at the end of the day further showed the desire of this group to utilize every opportunity of refreshing their knowledge of the specialty. The experience in Los Angeles tends to emphasize the responsibility of American ophthalmology to make available to the returning veteran the opportunity of renewing his acquaintance with clinical ophthalmology.

The officers of the Research Study Club who were responsible for the arrangements for the course and who "warmly welcomed as guests of the Club" those in the military service are to be commended for making available to many returning service men the very interesting and practical one-week course in ophthalmology.

Frederick C. Cordes.

THE CHALLENGE

It is possible that historical research would show that after every major war the victors have won, in addition to other things, the leadership in science, including medicine. To support this premise by a thorough study would be interesting but somewhat beside the point, for, whether we like it or not, the responsibility for leadership in the medical education of the world is one that is now placed on the shoulders of the United Nations, particularly North America, England, and possibly Russia. Europe is too devastated and debauched to stage a comeback for a good many years. Her influence as a center for medical and, what particularly concerns us, ophthalmic education began to wane following the last war. This is shown by a declining trend in the num-

ber of our postgraduate students, during the last two decades, who went abroad for the study of ophthalmology. In addition to the declining number, the quality of the students was obviously poorer than before World War I.

The interwar period in the United States was one of exciting progress in the evolution of medical education and postgraduate training. The results reflected by this magnificent training were revealed in the fine work done by our young medical officers and in the extraordinary statistics of the treatment of battle casualties in this war. Modern therapeutics played their part, but the credit truly belongs to the work of the civilian doctor in uniform for his superb professional care of the sick and wounded.

The influence that our Army and Navy hospitals, especially the "affiliated" units, have had by their impact on foreign physicians and surgeons everywhere in the world will begin to become manifest in the near future. The result will be an ever increasing number of observers, students, and medical missions from everywhere coming to our country and to our schools and hospitals to learn from us.

The mental and physical distress, during the war years and immediately thereafter, endured by Great Britain and suffered by the occupied countries has had and will continue for some time to have an unfavorable effect upon the development or expansion of their physical plants and facilities for medical education, as well as on the teachers themselves in those countries. The dogged leaders of British ophthalmology, however, were making splendid plans for the future of ophthalmic education and training even while flying bombs were exploding and air-raid sirens were wailing. These plans have made good headway, and it may not be long before various postgraduate

courses, long and short, are offered to the world. The situation in the defeated countries must be one of great pessimism. One does not know and at this stage scarcely cares to find out what happened to the leaders in ophthalmology in those countries. What little we have learned of the medical practice under Hitler, and the results as seen in the German military hospitals and in their terrible concentration camps, leads us to fear no rivalry from that detested source for a long time to come. Through no fault of ours, we know actually very little about Russian medicine and surgery. There is no doubt about the upsurge and vitality of medical science in Russia at the moment. The need for medical treatment brought on by and during the war has given an enormous impetus to the movement of earnest scientific education in that country. The position that the medical citizen under Stalin occupies is one of the highest prestige, and Russian ophthalmologists are in a particularly favorable light. The number and value of their scientific contributions are steadily increasing and becoming robust. It is exhilarating to watch their development. But their time will be too occupied and their facilities too limited to care additionally for the training of foreign postgraduate students in medicine, even if the latter were to be given free access into the country.

Thinking along these lines leads us to wonder whether we in the United States are prepared for and agreeable to the position of leadership in ophthalmic education. At the moment our facilities, too, are not enough to care for all of our own ex-medical officers who are looking for training in ophthalmology. There are too few ophthalmic residencies for one thing, and, for another, pathetically few medical schools are developing courses in basic ophthalmology. The pressure of the demand for such courses is becoming nearly

too great to bear, and more schools will be forced into giving them.

It is admittedly difficult for most medical schools to initiate and carry out basic and other courses in ophthalmology. This is partly because the ophthalmic staffs of many of the schools are essentially made up of voluntary clinicians who can spare but little time from their practices for the care of clinic patients, let alone teaching. It is also due to the rather low estate in which ophthalmologists are held by their fellows in general medicine and surgery, particularly on the faculties. This low opinion is a fact that was emphasized by Army experience. The attitude may be the result in part of the aloofness or clannishness or even inertia of the ophthalmologists themselves, but is probably the consequence of poor courses and propaganda in ophthalmology given to our general medical colleagues when they were medical students. Frankly, most of us have been too busy to teach our subject properly and with enthusiasm to the undergraduates. It may be necessary to "sell" ophthalmology to some of our medical schools in order to get necessary help in creating basic and even clinic courses. The Army or Navy ophthalmologist has done an excellent job of "selling" his specialty to his chief. Many of the latter have learned to hold in highest esteem the work of his ophthalmic medical officer and his place in the surgical specialties. At any rate, most of the chiefs of the surgical services in our Army hospitals have learned the difference between an optometrist and an ophthalmologist, which difference few of them knew or cared to know before the recent experience.

There is always the problem of sufficient financial backing for these undertakings. The fees for the courses probably will not cover the expenses. Equipment is difficult to find now and physical

things, such as suitable laboratory space and material and a lecture room, may be sadly lacking. More full-time or part-time teachers of ophthalmology must be provided for. Enough money must be raised for the eye departments of all our schools to develop and carry on the work of undergraduate and postgraduate teaching. There are 59 Class A medical schools in our country today and not more than six at the moment are giving or planning to give basic courses in ophthalmology.

We will have the backing of our ophthalmic associations and presumably that of the national medical societies as well in this venture. We will have the grateful support of the American Board of Ophthalmology, which is struggling with the problem of raising standards at a time of inadequate equipment for training and in the face of an overwhelming demand for such training.

Have we the energy, vitality, and initiative to accept the challenge and to seize the opportunity?

Derrick Vail.

BOOK NOTICES

THE FUNDAMENTAL COLOUR SENSATIONS IN MAN'S COLOUR SENSE. By Gustaf F. Göthlin. Seventy pages, 21 illustrations. Stockholm, Almqvist-Wiksell, 1943.

This summary in English of Göthlin's experimental results and theoretical views as to color vision marks a return of the author to this field of activity after a 20-year preoccupation with other subjects. The theoretical views are based upon the particular three-components formulation generated by choosing as fundamental colors red, green, and blue. Red plus green cancels to yellow, and yellow plus blue cancels to white. In these respects, Göthlin's views agree strikingly

with those put forward by Ladd-Franklin in 1892, which, surprisingly enough, are not mentioned by him. The mechanism by which red-green and yellow-blue cancellations are accomplished, however, is taken to be an inhibitory action in the central nervous system. These views are adequate to account for Göthlin's experimental results on energy thresholds for the red sensation, on the situation and extent of the purely yellow zone in the spectrum of anomalous trichromats; and on energy thresholds for the blue and violet sensations; and like the Ladd-Franklin theory they account for a large proportion of the known facts of vision. They have not, however, been developed very far beyond the qualitative stage and in some respects seem rather confused.

For example, Göthlin rejects the urge of previous advocates of the three-components theory to choose imaginary colors for primaries, thereby eliminating negative portions of the three spectral curves of trichromatic coefficients. He says (p. 60), ". . . these (negative portions) really mean that an impulse for a colour sensation of whatever quality releases to some extent an inhibition of impulses for the complementary colour sensation within the same area." Such a view implies that the spectrum primaries, to which the coefficient curves refer, can correspond to the fundamental colors, themselves; but it is also stated (p. 68) that "no isolated fundamental colour sensation can be experienced subjectively—with the *possible* exception that the most long-wave red in a completely pure spectrum may give such a sensation of red. . . ." The difficulty is treated most elegantly by G. E. Müller (*Z. Psychol.*, 1930, v. 17).

In spite of difficulties not resolved, and in spite of space wasted in summarizing inconclusive support for views already better supported by other work, there is

much in this summary to interest a student of visual theory. For example, the variations among different subjects with normal color vision in the position of the spectral zone for pure yellow are plausibly accounted for by supposing the existence of an individually varying proportion of the number of receptors for red and for green combined with a mass action giving more weight to the central impression of a fundamental color component when the number of its excited receptors is greater. Furthermore the perception by a congenitally yellow-blue-blind observer (the famous case of Alrutz) of the short-wave end of the spectrum as "red with black spots" may be explained in the same way. Even the highly elaborated theory of Müller does not seem to do quite as well on these points.

D. B. Judd.

GENERAL AND PLASTIC SURGERY. By J. Eastman Sheehan, M.D. 1st Edition, clothbound, 345 pages, 495 illustrations. New York and London, Paul B. Hoeber, Inc., 1945. Price \$6.75.

This book, which is the fifth in the career of the author, is not primarily a text for ophthalmologists but rather a treatise on general surgical techniques with an emphasis on war injuries.

The first four chapters deal with the agents which produce war wounds, the nature of such wounds, wound excision, and the control of wound infection. The author points out that prior to World War II, reliance was placed chiefly on bactericidal action, but after the power of the sulfonamides to induce bacteriostasis was demonstrated, attention has centered on this later method. Some space is devoted to the use of sulfonamides and penicillin. Chapter five deals with the subject of burns and their treatment. It is

encouraging to note that he recommends that the tannic-acid treatment be abandoned and the wound be treated as an open wound with special attention to the elimination of infection and replacement of lost skin as early as possible. The major portion of the text is devoted to the care of wounds, and an attempt has been made to cover the whole field of surgery. The section on wounds of the face includes wounds of the orbit, and the discussion on reparative procedures about the eyes is brief and incomplete. The chapter on tissue replacement demonstrates the different types of skin flaps and classifies skin grafts on the basis of their thickness. Some attention is devoted to the Padgett dermatome, and there is a discussion of plasma and white-cell fixation of grafts and the use of other materials for plastic repair. The last two chapters are devoted to the healing of wounds and elaboration on the details of surgery for repair of the nose, the mouth, facial contours, the eye, and the ear.

The illustrations, which are numerous, consist chiefly of line drawings, and there is a tendency to oversimplification.

The book is interesting and contains much informative material but it is not comprehensive enough to be classified as a complete reference book on modern operative methods. No one can be experienced and well informed in the whole field of surgery, and, in our present day of specialization, the need is for books which cover a small field thoroughly rather than those which cover the whole field inadequately.

Irving Puntenney.

CORRESPONDENCE

PRESBYOPIA ASSOCIATED WITH
ALTERNATING SQUINT

Editor,

American Journal of Ophthalmology:

I have been unable to find in the literature or texts any mention of the advantage to which alternating squint may be put in connection with prescribing lenses for the presbyopic. Nevertheless, a presbyopic patient with alternating squint can be made comfortable for both distance and near vision without the use of bifocals. I presume that others may have used the same means as I to accomplish this, for the method is simple and the results are greatly superior to those obtained with conventional glasses. However, if my method has been used before, no ophthalmologist appears to have taken the trouble to publish it, nor has it been mentioned in any textbook on refraction.

The method is simply to supply a distance lens for one eye and a near lens for the other. With a little patience and demonstration with the trial frame the patient readily learns how to use such glasses. If he is sufficiently presbyopic to need a +2.50 D.sph. addition, he can be given a distance lens for one eye and a bifocal for the other. The upper part of the bifocal would contain an addition of +1.25 D.sph. and the lower part an addition of +2.50 D.sph., the segments set high—up to the lower edge of the pupil. Thus he obtains the equivalent of a trifocal without being subjected to the inconveniences his neighbors have with their bifocals!

Care must be taken to differentiate between occasional squint and true alternating squint; for if a patient with the former type of strabismus is supplied with

these glasses, he will probably complain of diplopia or blurring. However, I have one patient who has an occasional squint with an exophoria of 30D. and who so disliked his bifocals that, in desperation, I suggested he try the method I have just outlined. He managed successfully to suppress vision in the non-used eye and went happily about his work with an alternating extropia which gradually grew to 50D.

Should the strabismic patient see well with both eyes but nevertheless use one eye almost exclusively, it might be advantageous to prescribe a bifocal for the dominant eye and a distance lens for the less-used eye. The patient can then use the dominant eye for both near and distance, but can switch to the other eye when going downstairs, walking over rough ground, and at other times when he requires good vision for distant objects below the level of his bifocal segment.

If one does, routinely, the simple muscle tests that are necessary to obtain a good eye examination, one will discover quite a number of presbyopic patients with alternating squint.

I do not know of any more grateful patients than these. All their lives they have considered their eyes inferior to the eyes of their neighbors. Now, finally, they can be told that the opposite is true—they belong to a very exclusive group of people who will never need to wear bifocals!

(Signed)

L. J. Alger, M.D.
Grand Forks, N.D.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

- | | |
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| 1. General methods of diagnosis | 10. Retina and vitreous |
| 2. Therapeutics and operations | 11. Optic nerve and toxic amblyopias |
| 3. Physiologic optics, refraction, and color vision | 12. Visual tracts and centers |
| 4. Ocular movements | 13. Eyeball and orbit |
| 5. Conjunctiva | 14. Eyelids and lacrimal apparatus |
| 6. Cornea and sclera | 15. Tumors |
| 7. Uveal tract, sympathetic disease, and aqueous humor | 16. Injuries |
| 8. Glaucoma and ocular tension | 17. Systemic diseases and parasites |
| 9. Crystalline lens | 18. Hygiene, sociology, education, and history |
| | 19. Anatomy, embryology, and comparative ophthalmology |

I

GENERAL METHODS OF DIAGNOSIS

Baltin, M. M. Falta's test in diagnosis of monocular blindness or marked reduction of vision or their simulation. *Viestnik Oft.*, 1944, v. 23, pt. 4, p. 22.

The best method for detecting simulation of monocular blindness should involve no special apparatus, should be quick, and should be capable of convincing lay persons. Falta's test consists in the patient fixing the examiner's finger at six inches from the nose and 1 cm. from the midline in the direction of the affected eye. Normally this is within the range of the near point of convergence. The finger is then brought closer and closer to the nose. A blind eye or an eye with marked reduction of visual acuity begins to turn out as the finger comes closer. In the presence of hyperopia or presbyopia +2 or 3D. lens is used in performing the test. M. Davidson.

Buerki, E. and Schmid, A. E. Histochemical investigations of the demon-

stration and localization of vitamin C in the eye. *Ophthalmologica*, 1943, v. 105, Feb., March, April, pp. 65-82 and 121-143.

The authors investigated various eye tissues for the presence of ascorbinic acid. Tissues of the eyes of normal and of scorbutic guinea pigs were placed in an acid silver-nitrate solution. Tissues containing vitamin C reduce this solution and show black granulated deposits within their cells. The eyes of normal guinea pigs showed reduction granules in the cells of the parenchyma and the epithelium of the cornea, the stroma of the sclera, the pigment epithelium of the iris, the stroma of the ciliary body, the choriocapillary layer of the choroid, the multipolar ganglion-cell layer of the retina and within the lens fibers. The optic nerve is practically free from ascorbic acid. Eye tissues from guinea pigs suffering from scorbutus had no reduction granules. The significance of this histochemical investigation for the question of the metabolism and cell mechanism of the

tissues of the eye is stressed and discussed. (Bibliography).

Max Hirschfelder.

Hruby, K. Slitlamp microscopy of the fundus without contact glass. *Klin. M. f. Augenh.*, 1942, v. 108, March-April, pp. 195-200.

To make the fundus visible in slit-lamp microscopy the angle between the axis of the lamp and of the microscope must be made very small, and an image of the fundus must be brought within the focal distance of the objective of the microscope. This has been done by means of a heavy, awkward, contact glass which cannot be used with children or nervous and sensitive adults. The reduction of the angle has been accomplished by Koeppe with a silver mirror and by Lindner with an angulated microscope. The Swiss firm Haag-Streit has replaced Koeppe's mirror with a prism which is very satisfactory. The author avoids the need for a contact glass by placing a 55D. concave spherical lens before the patient's eye in a spectacle frame. He recommends this as an adequate method, particularly to those who have a Haag-Streit slitlamp. Users of a Zeiss slitlamp will need a Lindner angulated monobjective microscope. (References.)

F. Herbert Haessler.

Koch, F. L. P. *Ophthalmodynamometry*. *Arch. of Ophth.*, 1945, v. 34, Sept., pp. 234-247.

Adequately to abstract this very complete review of considerable literature on ophthalmodynamometry is difficult. The author's own conclusions are as follows:

"It is unfortunate that the few studies which have been carried out in some detail with reference to the vari-

ous pressure relationships involved have not followed a relatively standard procedure with regard both to the ophthalmodynamometric methods and apparatus employed and to the classification of normal and of abnormal states according to uniform criteria of diagnosis. The reports in the available literature, however, with respect to investigations on the various vascular pressure relationships confront the worker in this field with an inescapable sense of the futility of efforts to arrive at any reasonably definite values for the normal retinal blood pressures. It becomes practically impossible, therefore, to rely diagnostically on the figures given by the various investigators for the retinal blood pressures in the numerous forms or stages of local and systemic hypertensive disease of whatever cause. It would appear to be much more reasonable to depend primarily on the information gained from a careful ophthalmologic examination, with particular reference to all of the changes that manifest themselves in the retinal vessels, particularly the arterioles, and in the retina and choroid as well, and these findings necessarily must be correlated with the results of the general physical examination."

R. W. Danielson.

Lathrop, G. E. *Microtechnique of pathologic eye*. *Amer. Jour. Clin. Path.*, 1944, v. 14, Nov., p. 131.

Tissue components of the eye are extremely variable. The succulent retina has to be fixed by a fluid which does not superimpose hardening on the toughness and friability of the cornea, the sclera, and the dural sheath of the optic nerve. For any purpose other than storage the pathologic eye should never be fixed in 10-percent formalin. Two for-

mulas are presented by the author for fixation. Dehydration must be accomplished with a minimum of shrinkage and distortion.

Theodore M. Shapira.

Niederhoffs, P., and Kemp, R. **Examination of the field of vision with a flicker perimeter.** *Klin. M. f. Augenh.*, 1941, v. 107, Sept., pp. 257-265.

The principle of this method has been described previously (*Amer. Jour. Ophth.*, 1936, v. 19, Oct., p. 912). In the meantime the apparatus has been somewhat modified. The visual stimulus produced by intermittently appearing and disappearing white and colored (pigment) lights is argued to give more accurate results in perimetry than other methods, not only for determining the limits of the peripheral visual field but also for evaluation of pathologic scotomas and the blind spot. In glaucomatous eyes, disappearance of the flicker phenomenon is observed where light perception for constant lights is still present. (3 figures, 2 tables.)

F. Nelson.

Scharf, Josef. **Demonstration of an intraocular foreign body by means of gonioscopy.** *Klin. M. f. Augenh.*, 1941, v. 107, Aug., pp 193-196. (See Section 16, Injuries.)

Shenkin, H. A., and Leopold, I. H. **Localizing value of temporal crescent defects in the visual fields.** *Arch. Neurol. and Psych.*, 1945, v. 54, Aug., p. 97.

These cases are presented to emphasize that careful perimetric studies may reveal a crescentic defect in the temporal portion of the visual field which is of practical importance to the neurologist and the neurosurgeon. A monocular crescent defect indicates the general

area involved by a tumor or other pathologic process.

In five cases presented here, unioocular temporal-crescent defects in the visual field were due to verified cerebral tumors involving the suprageniculate pathway. This finding is important as an early localizing sign.

Theodore M. Shapira.

Troncosco, M. U. **A new contact glass for gonioscopy.** *Amer. Jour. Ophth.*, 1945, v. 28, Dec., pp. 1360-1361.

Verrey, F. **An arrangement for capillary centrifugation.** *Ophthalmologica*, 1943, v. 105, March-April, pp. 151-155.

An arrangement is described whereby the centrifuged sediment from a capillary tube of aqueous may be placed on the cover glass. Smallest amounts of aqueous humor could be examined by this method from a cytologic and microbiologic standpoint.

Max Hirschfelder.

Vogt, Alfred. **Selected chapters from volume 3 of the author's Atlas of slit-lamp microscopy.** *Klin. M. f. Augenh.*, 1941, v. 107., Oct., pp. 435-442.

1. Vogt calls attention to the senile destruction of cells of the posterior pigmented epithelium of the iris and the deposition of their pigment in granules on the pupillary margin. Less well known is the pigment-cell destruction which occurs in the anterior mesodermic iris tissue during an attack of acute glaucoma and leaves a hitherto neglected picture, namely of areas of albinism or vitiligo of the iris. The pigment finds its way into the aqueous, and, being dense, is deposited in the dependent part of the chamber angle like blood cells in hyphema. Vogt suggests that this manifestation be called hypo-

melanosis. The peculiar lesion is often accompanied by changes in the lens cortex. These consist of branched opacities for the most part associated with the lenticular raphe. Unquestionably this cataract is produced in increased pressure which may be caused by glaucoma or a blow on the eye. In time the cataract sinks into the interior of the lens as new fibers grow over it.

2. Many observations, clinical and anatomic, lead the author to conclude that the hyaloid canal does indeed exist in the human vitreous and that its landmarks are gradually obliterated through a lifetime of stresses and strains produced in the vitreous by ocular movements. Hemorrhages sometimes delineate its anterior end, and are found 2 mm. nasal to the posterior pole of the lens. The postlental curvilinear white line which formerly was only of theoretic interest now has pathologic importance. Vogt also mentions that volume 3 of his Atlas contains many pictures which clarify posterior annular vitreous detachment.

F. Herbert Haessler.

2

THERAPEUTICS AND OPERATIONS

Aguirre, José. An essay of the real and comparative value of prontosil and albucid in the treatment of blennorrheal purulent conjunctivitis. *Rev. Oto-Neuro-Oft.*, 1944, v. 19, Oct., pp. 132-134.

The series treated consisted of 12 cases, eight of which occurred in children between 15 days and three years of age. The other four were in adults between twenty and forty years of age. The methods utilized were local instillation, injection, and peroral administration. All cases of this blennorrheal conjunctivitis improved with

treatment, and did equally well when using prontosil or albucid as a collyrium, or by injection. Albucid perorally yielded better clinical and bacteriologic results than prontosil.

Edward Saskin.

Amsler, M., and Verrey, F. The practical use of puncture of the anterior chamber. *Ophthalmologica*, 1943, v. 105, March-April, pp. 144-150.

Punctures of the anterior chamber for diagnostic reasons have been done in the Lausanne eye clinic on 1,065 eyes during the past two years. The puncture is made by a specially constructed needle. It is a harmless procedure and gives useful information as to the composition of the aqueous humor (albumin, cells) in different eye conditions. The reaction of the eye to the paracentesis with regard to exudation, tension, and resistance of the vessel is noted. Diagnostic puncture is of value in uveitis and other inflammatory conditions of the anterior part of the eye, in hypertension, in injuries, and before intraocular surgery.

Max Hirschfelder.

Arruga, H. Experimental and clinical studies with penicillin in ophthalmology. *Arch. de la Soc. Hisp.-Amer.*, 1944, v. 4, Sept.-Oct., p. 847.

Arruga demonstrated experimentally the antibacterial action of penicillin, by producing experimental corneal ulcers and intraocular infections and using one eye as a control. Before using penicillin clinically he demonstrated on patients and on himself that even a concentrated solution or ointment of sodium penicillin is well tolerated by the eye, provided that the penicillin is pure. He reports four cases of serpiginous ulcer, three of which recovered; in the

fourth the result was an opaque leucoma. The action of penicillin in these cases is not so spectacular as it is in general infections, but the drug is the best antiseptic at our disposal. Injections into the lacrimal sac were tried in six cases of dacryocystitis. The supuration cleared up in 3 to 9 days. In three cases the remaining exudate was clear, resembling the white of an egg. The ointment and drops were tried in various types of keratitis, as well as in traumatic ulcers, marginal ulcers, and neurotrophic disturbances. In acute pneumococcus conjunctivitis the action of penicillin was rapid, and less painful but no more effective than that of one-percent silver nitrate. In chronic blepharitis penicillin was no more effective than the currently used remedies. This fact supports the accepted view that in chronic blepharitis the local infection is less important than general disturbances, such as hepatic insufficiency or allergy. Ray K. Daily.

Asnarez, Jose. Rapid dacryocystorhinostomy. Arch. de la Soc. Hisp.-Amér., 1944, v. 4, Nov.-Dec., p. 1064.

The merit which the author claims for this technique is chiefly the rapidity with which the operation may be performed. He completes it in 15 to 20 minutes. The steps of the operation are: the usual incision with a knife; dissection with scissors; introduction of a mastoid speculum into the wound; isolation of the sac with scissors; incision of the sac as posteriorly as possible; introduction of three fine silk sutures into the anterior lip of the sac, which are laid aside; denuding of nasal wall of periosteum; perforation of the lamina papyracea; separation of nasal mucous membrane with a Citelli forceps; rapid enlargement of the osseous opening to the desired size; cutting a

flap of nasal mucosa in the shape of a C, and joining it to the lacrimal sac by the three sutures; a skin suture and slightly compressive bandage complete the operation. The author doubts the importance of a smooth and regular bony aperture, and claims that there is less likelihood of injuring the nasal mucosa with forceps. In 200 cases, there were 4 percent failures.

Ray K. Daily.

Atkinson, W. S. Interstitial keratitis treated with subconjunctival injections of penicillin. Arch. of Ophth., 1945, v. 34, Sept., p. 233. (See Section 5, Conjunctiva.)

Barrenechea, S., and Contardo, R. Penicillin in ophthalmology. Arch. Chilenos de Oft., 1945, v. 1, Jan.-Feb., pp. 12-17.

The authors have used penicillin locally or generally in 32 cases: 8 of chronic blepharitis, 16 of bacterial conjunctivitis, 3 of corneal ulcer, 2 of perforating corneal wound, 1 of panophthalmitis secondary to orbital cellulitis, and 1 of acute iritis. Excellent results were had in all these cases. (References.)

W. H. Crisp.

Bashoff, P. H. The results of corneal transplantation and plastic operations. South African Med. Jour., 1945, v. 19, June 23, p. 209. (See Section 6, Cornea and sclera.)

Bonaccolto, G. Extraction of dislocated lenses from vitreous. Amer. Jour. Ophth., 1945, v. 28, Dec., pp. 1335-1339.

Bordas, F., and Burch, M. The technique of dacryostomy. Arch. de la Soc. Hisp.-Amér., 1944, v. 4, Nov.-Dec., p. 1044.

This is a well-illustrated description

of the authors' technique of external dacryocystorhinostomy which they perform as an ambulatory operation. Burch designed eight burrs of various shapes and sizes, the purpose of which is rapidly to produce an adequate osseous opening into the nose without damaging the periosteal surface of the nasal mucosa. The incision into the lacrimal sac and the anastomosis with the nasal mucosa follows closely that of Dupuy-Dutemps. Fine silk is used for the sutures and a Beaupre epilation forceps serves most conveniently as needle holder for the fine needles. In order to keep the anterior flap from retracting backwards and blocking the new intranasal opening, the central suture of the anterior flap is brought out through the wound and tied to the skin suture. Two days after the operation the sac is irrigated through the lacrimal puncta. The nasal packing is discontinued on the fifth day and the cutaneous sutures are removed on the sixth or seventh day. Of 52 patients thus operated on, the results were satisfactory in 49. In one case the failure was due to a hypertrophied middle turbinate; in one to cicatricial bands within the sac, and in the third no reason for the failure could be discovered. (7 illustrations.)

Ray K. Daily.

Brausewetter-Koppner, G. Comparison between trephining (Elliot) and iridencleisis (Holth). *Klin. M. f. Augenh.*, 1942, May-June, v. 108, p. 303.

In order to allow a proper comparison of the effect of two fistulating antiglaucomatous operative procedures, Elliot's trephining was performed on one eye of 75 patients with bilateral glaucoma and Holth's iridencleisis on the other. After trephining 11 eyes required a second operation, after iriden-

cleisis 19 eyes. Four eyes were lost after trephining, one after iridencleisis had been performed, and 13 eyes were almost or completely blind before operation. Five trephined eyes became infected postoperatively, two of them immediately. All late-infected eyes were lost. In one case sympathetic ophthalmia resulted in total blindness of both eyes. Seven eyes developed cataract after Elliot's operation and four after Holth's. Free fistulation was observed after 11 trephinings and 6 iridencleises. Of fifty patients who were operated on only once in each eye trephining failed to reduce the tension in three and iridencleisis in four. Eleven trephinings and ten iridencleisis required at least a second operation. Thirty-five trephinings and 36 iridencleises were successful in preserving the function of the eyes, though some of these eyes were under observation for only one year. Trephining is the more dangerous operation because of the occurrence of infections. After iridencleisis no infections were observed. From the cosmetic standpoint trephining with peripheral iridectomy is preferable. The course of the glaucoma in both eyes of an individual patient did not differ regardless of which operation was used. (1 diagram, 1 chart, bibliography.) F. Nelson.

Carrasco, Guijarro. Short wave in ocular infections. *Arch. de la Soc. Hisp-Amér.*, 1944, v. 4, Nov.-Dec., p. 1079.

Two cases are reported. The first concerns a five-year-old child with a metastatic purulent endophthalmitis, subsequent to an acute exanthema. There was an enormous exophthalmos, extensive hard chemosis, evidence of pus within the eyeball, severe pain,

fever, and prostration. Short-wave therapy rapidly relieved the pain, and after the third or fourth treatment the general condition of the child was much improved; the child recovered with an atrophic eyeball.

The second patient had an orbital abscess as a complication of a severe erysipelas, which was treated by drainage and multiple incisions. The recovery was definitely accelerated by short-wave therapy. Ray K. Daily.

Cetner, J. A. Practical method for application of ophthalmic ointments. U. S. Naval Med. Bull., 1945, v. 45, Oct., p. 767.

To facilitate insertion of ointments directly into the conjunctival sac when collapsible tubes are not available, the use of an ordinary 2-c.c. glass syringe is suggested. It is particularly recommended in epidemics when large numbers of patients must be treated.

Morris Kaplan.

Chulia, Vicente. Repair of an extensive posterior symblepharon. Arch. de la Soc. Hisp.-Amer., 1944, v. 4, Nov.-Dec., p. 1070. (See Section 5, Conjunctiva.)

Costi, C. X-ray therapy in inflammatory ocular diseases. Arch. de la Soc. Hisp.-Amer., 1944, v. 4, Nov.-Dec., p. 1072.

Costi urges X-ray therapy in inflammatory ocular conditions which fail to respond to the usual therapeutic procedures. The dose required for inflammatory lesions is very small and is in inverse ratio to the intensity of the inflammatory process. He reports a grave case of bilateral cellulitis, and a case of severe corneal abscess which responded well to X ray irradiation, after failing to improve on sulfa drugs

and foreign-protein therapy. He uses irradiation in acute or subacute dacryocystitis to reduce the inflammatory process preparatory to surgery. This enables him to work with good anesthesia and hemostasis, which is difficult to obtain in the acute inflammatory stage. Ray K. Daily.

DeVoe, A. G. Surgery of the anophthalmic orbit. Amer. Jour. Ophth., 1945, v. 28, Dec., pp. 1346-1351.

Djacos, C. Modern tattooing of the cornea. Arch. d'Ophth., 1945, v. 5, no. 1, p. 36.

The author gives a historic review of the subject of corneal tattooing and describes in detail both the method of Knapp in which gold chloride is employed and that of Rollet who injects a nonabsorbable coloring matter into the leucomatous cornea. The latter method is favored. The author injects a 2-percent solution of India ink into the corneal stroma in the proper location by means of a special metal syringe designed by Raison. In cases of extensive leucoma two or three punctures are made and great care is taken not to inject an amount which elevates the corneal epithelium. Five cases are cited in which satisfactory results were obtained. After two years there was no attenuation of the coloration or migration of the pigment.

The method of Knapp has the disadvantage that the solution of gold chloride is caustic and requires neutralization. From 1- to 4-percent solutions are employed according to the thickness and whiteness of the leucoma. Two cases are reported. In one the cosmetic result was good, but in the other the pigmentation was not uniform. Djacos notes that there is a marked

uveal reaction and that patients complain of much postoperative pain. Furthermore the coloration is not permanent and repetition of the tattooing is necessary after a period of several years. There is also a tendency towards vascularization of the impregnated area.

Phillips Thygeson.

Fassbind-Knapp, Dora. **Condensed survey of the technique and results of chemical tattooing of the cornea.** *Klin. M. f. Augenh.*, 1942, May-June, v. 108, p. 262.

The advantages of tattooing the cornea with gold chloride and other metallic salts, especially platinum chloride, are the simplicity of the process, the comparatively insignificant postoperative irritation, the possibility of treating thin and adherent scars without danger of perforation, the rarity of postoperative complications and the beautiful cosmetic result. A disadvantage is the frequent impermanence of the result, which, however does not exclude repetition of the process. A good cosmetic result may last for several years. The method is contraindicated when the corneal tissue is seriously impaired or where inflammatory processes are still active. The article contains a history of corneal tattooing, a discussion of methods, clinical observations, advice about the use of different metallic salts, a statistical survey, and some histologic findings. She also mentions the possibility of tattooing the palpebral conjunctiva of albinos to eliminate some of the glare and adds observations about the deposition of gold into the cornea in patients who have been treated with colloidal gold solutions (sanocrysin) intravenously. (2 microphotographs, bibliography)

F. Nelson.

Friede, Reinhard. **The treatment of ocular infections with sugar.** *Klin. M. f. Augenh.*, 1941, v. 107, Oct., pp. 404-410.

In ophthalmology sugar is used therapeutically in two ways: 1. Intravenous injections of 20- to 50-percent dextrose solution to reduce tension by removing water. 2. Local application to cornea and conjunctiva where too the basis of action is a reduction of swelling by osmosis. The author has experience with 60 cases of ocular disease and finds diseases of the anterior and middle layers of the cornea susceptible to this form of therapy. It has been most promising with clearing of corneal transplants which have become clouded.

F. Herbert Haessler.

Gradle, H. S. **Prevention of wound rupture after cataract extraction.** *Anal. Argentin. de Oft.*, 1944, v. 5, Jan.-Feb.-March, pp. 13-16.

Postoperative corneoscleral ruptures may be classified as simple fissure of the incision, frank rupture with destruction of new-formed capillaries and hyphema, and extensive rupture with iris prolapse. In 200 consecutive cataract extractions, the author claims an incidence of 35 percent the first type, 15.5 percent of the second type, and 2.5 percent of the third most serious group. There was no correlation between these ruptures and the ability of the surgeon or the procedure employed.

Gradle feels that the genesis of wound rupture may be traced to pressure on the globe by the orbicularis muscle, in conjunction with the recti. To overcome this hazard, he performs an oblique tenotomy of the orbicularis muscle near the outer canthus in both lids, with a subsequent marked reduction in the incidence of all types of

cataract-wound rupture. (3 illustrations.)
Edward Saskin.

Hartmann, Karl. The treatment of anomalies of the position of the lids by means of electrocoagulation. *Klin. M. f. Augenh.*, 1942, v. 108, May-June, p. 342.

Scarring of the conjunctiva in ectropion with silver nitrate, sulfuric acid, or Paquelin cautery has been used for years in order to shorten the surface of the conjunctiva and to straighten the lid. The author used electrocoagulation with the diathermic needle for the treatment of entropion and ectropion. This method is recommended especially for cases of senile ectropion and eversion of the lacrimal puncta with epiphora. The result is said to be more complete and permanent because extensive scars develop in all the tissues of the lid. Several rows of point-like diathermy punctures are placed in the conjunctiva in ectropion and in the skin of the lid in entropion. (4 case reports, 2 drawings, literature excerpts.)
F. Nelson.

Himmelmann, W. Scopolamine-enedodal-ephetonin injections in ophthalmology. *Klin. M. f. Augenh.*, 1942, v. 108, March-April, pp. 214-217.

The author recommends this form of general narcosis for ophthalmic surgery, particularly in strabismus, retinal detachment, and plastic surgery. In 370 operations there were no circulatory mishaps. (References.)

F. Herbert Haessler.

Karbucher, P. Combined corneal abrasion and iridectomy in cases of metaherpetic parenchymatous keratitis, corneal tuberculosis and other corneal inflammation combined with iridocy-

clitis. *Klin. M. f. Augenh.*, 1942, v. 108, March-April, pp. 184-187.

The author reports nine brief case histories to illustrate very satisfactory results from the application of the surgical procedure described in the title. The procedure was devised by Vogt.
F. Herbert Haessler.

Kötz, H. A statistical study of hemorrhage after operations for senile cataracts. *Klin. M. f. Augenh.*, 1942, v. 108, May-June, p. 291.

The author presents a statistical analysis of the postoperative hemorrhages which occurred after extraction of 750 senile cataracts in the years 1938 to 1940. In the group of 440 otherwise uncomplicated senile cataracts hemorrhages occurred in 18.9 percent, most frequently on the 4th or 5th day. The percentage of hemorrhages after intracapsular extraction was almost twice as high as after extracapsular extraction. The greatest number of hemorrhages was found in December. In females the occurrence of hemorrhages increased with advancing age. Males were particularly predisposed in the fifth decade of life. Controlled diabetics were not more predisposed to bleeding, nor were hypertonics, provided they were preoperatively treated with ample bleeding. Glaucomatous patients were equally predisposed to hemorrhages as arteriosclerotics. Postoperative hemorrhages not only influence the duration of hospitalization (average 23 days as against 18 days in uncomplicated cases) but also the final result of the operation. Kötz recommends saturating doses of vitamin C in the preoperative and postoperative period for all cataract patients. (Bibliography.)
F. Nelson.

Lehrfeld, L. Revaluation of Her-

bert's flap operation for glaucoma. Arch. of Ophth., 1945, v. 34, Sept., pp. 191-194. (See Section 8, Glaucoma and ocular tension.)

Leopold, I. H. Local toxic effect of detergents on ocular structure. Arch. of Ophth., 1945, v. 34, Aug., pp. 99-102.

A number of detergents are in use in ophthalmology as germicides and cleansing agents but more particularly to aid in the penetration of therapeutically active substances through the cornea. Experiments were conducted on the normal and on the abraded rabbit cornea to determine whether or not the detergents exerted a local toxic effect on the eye. The agents tested were Aerosol OT, Aerosol OS, Tergitols 4 and 7, Tergitol 08, Zephiran, and Duponal ME dry.

It was found that repeated application of detergent solutions produced conjunctival damage in concentrations as low as 0.1 percent. Zephiran chloride in this concentration produced corneal damage. Repeated applications of higher concentrations of all of the agents tested produced superficial corneal changes in normal rabbits. Regeneration of corneal epithelium was retarded by the repeated application of solutions containing 0.5 percent of each detergent and to a slight degree by solutions of 0.1 percent. The tissue damage resulting from one application of the undiluted agents is reparable. The damage observed is in the cornea and conjunctiva with no involvement of the deeper structures. These studies do not contraindicate the use of the detergents; they simply call attention to the toxic property of these compounds.

John C. Long.

the eye. Klin. M. f. Augenh., 1942, v. 108, May-June, p. 319.

Since the introduction in 1930 of diathermy as a method for closing tears of the retina, the use of diathermy has been considerably expanded. Weve, Imre, and Csapody reported successful destruction and cure of an intraocular malignant melanoma. After a complete blockade of the whole area surrounding the tumor the latter was burned out with electric-wire cautery. Since no exact data concerning the strength of the current nor the duration of its application in such operations have been published the author undertook to find out these requirements experimentally in rabbit's eyes. One series of eyes was enucleated immediately after the operation, another after one week, and a third after two months and examined histologically. In all eyes a thorough destruction of the retina was found in the treated area. Extensive hemorrhages were also always present. The diathermic coagulation not only acts locally but leads to considerable hyperemia and hemorrhages in more distant areas of the eye because it raises the intraocular temperature. The effect of a known strength of current varies with several factors, such as more or less perfect contact between the electrode and the sclera, dryness of the field of operation, and degree of local hyperemia. Histologically no thrombosis of the vessels was found, and hyperemia was still considerable on the seventh day after operation. The author was unable to produce a complete coagulation blockade of the area where a tumor was anticipated. The strong reaction of the choroid, excessive hyperemia, and the lack of thrombosis in all eyes, whether treated with a current of 40 to 50 or 60 to 70 milliamperes for

Lugossy, G. Effect of diathermy on

one to three seconds, showed that the necessary strength of the current and the optimal time of application have not yet been determined and that further research is required to avoid grave danger in treating malignant uveal tumors with diathermy. (6 microphotographs, bibliography.) F. Nelson.

Luzsa, Andreas. The effect of silver-nitrate solution dropped in before an eye operation. *Klin. M. f. Augenh.*, 1941, v. 107, Sept., pp. 231-234.

To render harmless pathogenic germs present on the human conjunctiva, at least for a certain danger period, it is recommended to instill a 1-percent silver-nitrate solution on the bulbar conjunctiva of patients who are undergoing an operation which opens the globe. This should be done after giving the local anesthetic, and immediately before the operation is performed. Culture tests, as well as clinical experience with conjunctival irrigation fluid proved the value of this procedure. Possibly the thin and invisible coagulation membrane produced by silver-nitrate solution fixes, at least for the duration of the operation, any germs still present. (References.) F. Nelson.

Malbrán, Jorge. Restoration of the socket or the lower cul-de-sac after enucleation. *Arch. de Oft. de Buenos Aires*, 1943, v. 18, Aug., p. 394.

After a brief review of the different operations for the reconstruction of the socket or conjunctival cul-de-sac, the author describes Wheeler's operation and considers it the ideal procedure because of its simplicity and excellent results. (Bibliography.)

Plinio Montalván.

Malbrán, J., and García Nocito, P. F. Burch's operation. *Arch. de Oft. de*

Buenos Aires, 1943, v. 18, Aug., pp. 399-404.

Based on their experience, the authors prefer Burch's operation to enucleation. This consists of evisceration with implantation of a gold or lead-free glass sphere in the scleral cavity. They used vitallium and lucite spheres, preferably the latter. The implant has never been expelled in any patient. (1 illustration.)

Plinio Montalván.

Moreu, Angel. Goniotrabeculotomy and goniocyclodiathermy. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1944, v. 4, Nov.-Dec., p. 1011.

The author's procedure seeks to combine the advantages and eliminate the undesirable features of Barkan's goniotomy and Vogt's cyclodiathermy. He does not agree with Barkan on the important role which sclerosis of the walls of Schlemm's canal and obstruction of the pectinate ligament with detritus or pigment have in the pathogenesis of primary glaucoma. In ten years of gonioscopic study he never encountered the signs described by Barkan as indicative of sclerosis of the walls of Schlemm's canal. The usual finding is an edema of the ciliary body accompanied by a slight exudate which penetrates the meshes of the pectinate ligament and gives rise to peripheral synechia; new blood vessels form around Schlemm's canal, and exudates finally obliterate the angle of the anterior chamber. The typical glaucomatous lesions consist of an edema of the uvea and a resultant irido-cyclo-choroidal stasis. The author believes that goniotomy is indicated only in trabecular, infantile, absolute, and malignant glaucoma, and in hypertension secondary to uveitis. The presence of peripheral

synechiae is a contraindication to goniotomy; in such cases separation of the iris is followed by a hemorrhage, and an examination several days later reveals a re-formation of the synechiae, sometimes in increased numbers. Post-operative examination of patients treated by goniotomy revealed that the main defect of this procedure is the increased formation of trabecular synechiae which leave the angle of the anterior chamber in a worse state than it was before the operation. It occurred to the author to supplement goniotomy with diathermy. The advantage of this procedure over Vogt's cyclodiathermy consists in the more direct approach to the ciliary body, in reducing the numbers of punctures, and in not disturbing the pericorneal vascular network. With the gonio-cyclodiathermy the peripheral synechiae are divided without hemorrhage, and the edematous areas of the ciliary body are coagulated relieving the stasis and edema of this area; the coagulated areas, surrounded posteriorly by an inflammatory zone leave an atrophic cicatrix. In this operation there are two distinct procedures which may be used separately or combined: cutting with an electric current and diathermy puncture. The operation is performed under gonioscopic guidance through a Koeppe contact lens which has a perforation on the side large enough to permit the passage of a Ziegler knife-needle. The knife-needle is introduced through the cornea, passed through the anterior chamber, and fixed in the synechia; it is then connected to a diathermy terminal, and a current of 60-70 milliamperes is used to cut the synechia. For coagulation of edematous areas in the ciliary body a fine needle 1.5 mm. in diameter is intro-

duced in the same manner, and 40-50 milliamperes of diathermy passed through the area; 6 to 8 such punctures are made. In the combined procedures it is preferable to begin by coagulation, cutting the synechiae afterwards. The author believes that this operation is indicated in all cases where a goniotomy or cyclodiathermy is considered. (2 illustrations, 6 graphs.)

Ray K. Daily.

Muldoon, W. E. Restoration of patency of nasolacrimal duct. *Amer. Jour. Ophth.*, 1945, v. 28, Dec., pp. 1340-1345.

Mylius, Karl. Dimming of the psyche in ocular surgery. *Klin. M. f. Augenh.*, 1941, v. 107, Sept., pp. 225-230.

After paying tribute to Koller, who first applied cocaine as a local anesthetic for eye operations, Mylius points out that it is sometimes desirable or necessary to supplement local anesthesia with an agent that is not a general anesthetic but which puts the patient completely to sleep. Morphine has a number of well-known disadvantages. Avertin, per rectum or intravenously, has not fulfilled expectations. Evipal sodium represented a definite improvement but sometimes produced undesirable incidental and secondary effects, such as muscle jerks, sneezing, coughing, and defense movements. A combined solution of scopolamine-eucodal-ephedrin (S.E.E.—Merck) which can be injected intravenously and should be administered after the patient has entered the operating room, is superior to all previous agents, since with it undesirable by-effects are not observed. It does not put the patient to sleep but dims his emotions and eliminates anxiety even in very nervous and excited persons. It

produces complete equanimity but not unconsciousness, so that the patient never loses control and is always able to coöperate intelligently with the surgeon. Even such prolonged operations as retinal detachment can be carried out safely with this method. Combined with local anesthesia the analgesic effect of S.E.E. is strong enough to allow otherwise painful operations, for example, acute glaucoma and strabismus operations, to be performed absolutely pain free. The postoperative value of S.E.E. includes absolute relaxation of the patient and a pain-free period of many hours after the operation.

F. Nelson.

Ohm, J. The objective detection of night blindness in retinitis pigmentosa with the help of the optokinetic nystagmus. *Klin. M. f. Augenh.*, 1942, v. 108, Jan.-Feb., p. 61.

Since Rieken, who first used optokinetic nystagmus for objective adaptometry, has not yet dealt with retinitis pigmentosa, Ohm is presenting his first observations with two such cases. The inadequate light sense and the disturbance of the dark adaptation in retinitis pigmentosa could be demonstrated and measured quantitatively with the help of optokinetic nystagmus in two patients. One was a male aged 19 years and the other of a female aged 38 years. (6 kymographic curves, 2 references.)

F. Nelson.

Poleff, L. The real value of treatment by sulfonamides in trachoma. *Ophthalmologica*, 1943, v. 105, March-April, pp. 156-174. (See section 5, Conjunctiva.)

Rhode. The mechanism of action of the sulfonamides and their significance in ophthalmology. *Klin. M. f. Augenh.*

1942, v. 108, Jan.-Feb., p. 1.

Many theories have been advanced concerning the mode of action of the sulfonamides on bacteria in vitro and in vivo. None of them have been absolutely satisfactory nor explained fully the effect of the various sulfa drugs. Some authors believe that formation of peroxides in the organism is responsible for the destruction of germs in the body, others that sulfa drugs produce an increase of phagocytosis or a wall of leucocytes to stop the invasion of bacteria. It seems certain that bacteria are damaged by the drugs, particularly in vivo, and their growth stopped to a certain degree. Bacilli require certain substances in order to grow; e.g. p-amino-benzoid acid, which is probably formed by the bacteria themselves. Since p-amino-benzoic acid apparently is antagonistic to sulfonamides and can render them ineffectual this substance may be responsible for the ineffectiveness of sulfonamides in cultures.

In the field of ophthalmology sulfa drugs have been used with success locally, orally, and parenterally for combatting various bacterial and virus infections such as iridocyclitis with hypopyon, vitreous abscesses, dendritic and herpetic keratitis, corneal ulcers, infections of the lids, gonorrheal ophthalmia, and trauma. Prontosil, sulfanilamide, and sulfathiazole have been most used. (Bibliography.)

F. Nelson.

Rossi, Silvano. Irradiation of the cervical sympathetic in arterial hypertension. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1944, v. 4, Nov.-Dec., p. 1023.

Reference is made to a former publication on the efficacy of irradiation of the cervical sympathetic in glaucoma.

(Casanova "La irradiacion del simpatico cervical en el glaucoma-Clinica"). In this presentation the author wishes to add another indication for this procedure, that is, the reduction of the intraocular pressure in cases in which surgery was inadequate. The experience with postoperative irradiation gives the impression that in addition to mechanical factors controlled by surgery, there exist in glaucoma complicated processes directly under control of the neurovegetative nervous system, which respond to irradiation of the cervical sympathetic, thus achieving a satisfactory result which is not obtained by surgery alone. He describes a patient who still had an average tension of 48 mm. Hg after an Elliott trepanation. After three irradiations the tension was reduced to 22 mm. Hg and remained at this level without the use of miotics. Casanova also reports observations on three patients in whom the tension remained normal for almost two years after it had been reduced by irradiation. On the basis of this experience the author urges that irradiation of the cervical sympathetic be tried before subjecting the patient to a second operation. Assuming that a neurovegetative neurosis is an important factor in the development of glaucoma, irradiation is probably effective by presenting a barrier to the transmission of impulses, and freeing the eye from the excessive influence of the sympathetic nervous system. The clinical effect of the irradiation on the eyes is more lasting than the inhibition of the sympathetic itself. This suggests that a readjustment has probably taken place in the ocular tissues and blood vessels. Experimental irradiation on animals indicates that irradiation acts on the synapse within

the ganglion, altering its capacity to conduct stimuli, possibly by a change in cellular permeability. Retinitis pigmentosa and organic and functional obstruction of the retinal vessels are suggested as fields of investigation for this form of therapy. Ray K. Daily.

Schultz, A., and Jaeckle, C. E. Plastic surgical repair about the eyes with free grafts. *Arch. of Ophth.*, 1945, v. 34, Aug., pp. 103-106.

The surgical correction of scarred deformities about the eyes has assumed increasing importance as the result of war injuries. It is preferable to have plastic surgical procedures about the eye performed by the properly trained ophthalmic surgeon because of his special knowledge of the physiology and anatomy of the eye and its adnexa. The authors review the technique and indications for the use of mucous-membrane grafts, free epithelial grafts, and free full-thickness grafts. The use of the mucous-membrane graft is illustrated in the correction of a symblepharon produced by a lime burn.

As an illustration of the use of free epithelial grafts the authors report a case of plastic repair of the orbit by epithelial inlay. A full-thickness free graft was used to correct a cicatricial defect of the upper lid.

John C. Long.

Sorsby, Arnold. Local penicillin for ophthalmia neonatorum. *Brit. Med. Jour.*, 1945, June 30, p. 903. (See Section 5, Conjunctiva.)

Stocker, F. W. Response of chronic simple glaucoma to treatment with cyclodiathermy puncture. *Arch. of Ophth.*, 1945, v. 34, Sept., pp. 181-186.

(See Section 8, Glaucoma and ocular tension.)

Thiel, R. The mydriatic effect of various sympathetic stimulants (aryl-alkylamines). *Klin. M. f. Augenh.*, 1942, v. 108, Jan.-Feb., p. 10.

A. Experimental section: The effect of twenty different substances of the aryl-alkylamine group on human eyes were exactly recorded under uniform conditions. The intensity of light was uniform and relatively high in order to approximate the condition of clinical examinations. The size of the pupils was measured with Landmann's pupilometer, accommodation was tested with Adam's accommodometer, the intraocular pressure with Schiøtz's tonometer (model 2). Instillation was done while the patient was in a horizontal position. Standardized pipettes were used in order to safeguard uniformity in size of drops. Usually 15 persons were subjected to the test with each substance. With substances which produced irritation of the eye and apparently had little or no effect on the pupils a smaller number of tests was made. The age of the persons used varied since it is known that pupils of young people dilate more readily and extensively than those of older ones. (The following chapter has to be read in the original since it would not be understandable without the help of the given chemical structural formulas and curves.) The experiments gave evidence that the strongest mydriatic effect can be obtained with primary amines as 1-phenyl-2-amino-propan. The secondary related amines have a much lesser effect and the tertiary bases are not effective at all.

B. Clinical section: For diagnostic purposes it is desirable to have a drug

which dilates the pupil quickly and extensively, and produces a mydriasis of short duration. It is also desirable that the pupillary reaction to light be abolished, that accommodation and intraocular pressure (glaucoma and preglaucoma) are not affected, that mydriasis can be reversed by application of miotics at any time, and that the drug is tolerated well. Therapeutically the amines are useful in many cases where cycloplegics like atropine, scopolamine, and homatropine, do not produce the desired dilation (iritis, iridocyclitis) and where an additional mydriatic effect is desired. The amines can be used in combination with cycloplegics in the form of drops or ointments. The effect of the amines is due to irritation of the sympathetic fibers of the dilator of the iris. (18 graphs, 2 charts, 4 photographs, report of 10 cases.)
F. Nelson.

Von Sallmann, L. Penetration of penicillin into the eye. *Arch. of Ophth.*, 1945, v. 34, Sept., pp. 195-201.

This paper reports additional work by the author on the penetration of penicillin into the eye when used locally. Three local methods, designed to introduce comparatively high concentrations of drugs into the anterior segment of the eye, were tested on rabbits and the results compared. The methods were subconjunctival injection, iontophoresis, and the application of cotton packs saturated with a solution of penicillin.

After the subconjunctival injections the author noted that the conspicuous bulging of the conjunctiva visible for four to six hours was apparently due to the accumulation of tissue fluid, since the concentration of penicillin in the aqueous and tissue extracts decreased

steadily after the first hour. There was no indication that any of the examined fluids and tissues retained penicillin for more than six hours.

The solution of penicillin injected contained 5,000 Oxford units per c.c. It is questionable whether solutions of this strength can be employed subconjunctivally in the human eye without producing a severe reaction. In two patients a solution containing 2,000 Oxford units per c.c. caused obvious discomfort.

A comparison of the three methods showed that the highest concentration was obtained in the aqueous by iontophoresis, and in the cornea, the iris and ciliary body by the prolonged application of cotton packs. The lowest concentration of penicillin in the aqueous, the cornea, and the iris with ciliary body was observed after subconjunctival injection.

Extremely high concentrations of penicillin were found in the cornea, the iris, and ciliary body after the application of cotton packs saturated with a solution of sodium penicillin containing 20,000 Oxford units of penicillin per c.c. The penicillin content of the aqueous was also higher than that obtained with the other methods tested.

The depletion of penicillin from the ocular tissues and the aqueous was almost complete eight hours after iontophoresis with a solution of sodium penicillin containing 5,000 Oxford units of penicillin per c.c. and after application of cotton packs saturated with a solution containing 20,000 Oxford units per c.c.

In general, not more than traces of penicillin were demonstrated in either the lens or the vitreous after topical administration.

Determinations on four human eyes

with normal and with edematous corneas gave more erratic results and much lower values than determinations on rabbits' eyes. R. W. Danielson.

Wright, R. E., and Stuart-Harris, C. H. Penetration of penicillin into the eye. *Brit. Jour. Ophth.*, 1945, v. 29, Aug., pp. 428-436.

Twelve cases are reviewed in which various methods of penicillin administration were used. In five of these cases the fluids showed detectable inhibitory action. Penicillin reaches the aqueous humor when given by local irrigation or by intramuscular injection, but the concentrations obtained are variable and often low. By the use of iontophoresis, higher intraocular concentration can be obtained. The fluid from the three eyes treated by ionization showed definite bacteriostasis. In only one of the eyes treated by irrigation was a comparable inhibition obtained.

At present it is impossible to define the concentration of penicillin necessary for therapeutic effect in either blood or tissue fluid. It may be that the small amounts of penicillin reaching the aqueous humor after intramuscular injections or irrigations will prove to be clinically adequate, but the fact that high intraocular concentrations can be obtained by iontophoresis is worthy of further investigation. (2 tables, references.)

Edna M. Reynolds.

3

PHYSIOLOGIC OPTICS, REFRACTION, AND COLOR VISION

Birch-Hirschfeld. Disturbances of the light sense in aviators. *Klin. M. f. Augenh.*, 1942, v. 108, Jan.-Feb., p. 56.

As already pointed out by Italian authors, especially Colojani, ocular and

extraocular factors play a part in the deterioration of the light sense of flyers. Of importance are: 1. vitamin-A deficiency, 2. diseases of the liver and other general pathologic conditions, 3. neurovegetative disturbances, 4. decrease of atmospheric pressure, 5. diseases of the nose and labyrinth. When a group of aviators has been transferred to a new and different environment a reexamination of the light sense of such personnel is advisable.

F. Nelson.

Comberg, W. The ring defect in the visual field of wearers of glasses. *Klin. M. f. Augenh.*, 1941, v. 107, Dec., pp. 585-589.

An inherent defect exists in spectacle lenses which is well known but possibly generally neglected when considering a patient's difficulties in accustoming himself to his first glasses. A concave lens reduces the image of that part of the object which is seen through it. Consequently a second image of those parts of the object which are seen through the marginal zone of the lens is seen just beyond the limits of the lens. This produces a diplopia which is sometimes disturbing. A convex glass enlarges the image, consequently the part of the image seen through the marginal zone of the lens overlaps the adjacent image and produces a zone of blurring which in effect cuts out a portion of the object. Comberg has measured and recorded graphically the distance at which glasses of varying dioptric power cut out (+ lens) or duplicate (- lens) a zone 20 cm. wide, roughly the size of a human head. (2 graphs.)

F. Herbert Haessler.

Costi, C. Nocturnal myopia, sugges-

tions of ophthalmic interest. *Arch. de la Soc. Hisp.-Amer.*, 1944, v. 4, July-Aug., pp. 621-627.

Nocturnal myopia is defined in the following way: When the brightness of an object observed by an eye of normal accommodative power is low, the distance of the punctum remotum is reduced. The average value obtained is two diopters, that is, the eye is made myopic to that degree. The test demonstrating this phenomenon is made by projecting a luminous cross on a screen. With ordinary illumination the cross is seen clearly, but as the illumination is reduced the cross becomes blurred. The cross is again seen clearly as minus lenses are introduced up to two diopters.

The fact that neither atropinized eyes nor eyes with advanced presbyopia show the phenomenon seems to indicate that the mechanism is accommodative. Based on the above observation the assumption is that eyes of normal accommodative power have from 1.5 to 2.00 diopters of negative accommodation. A practical application is cited. A myopic chauffeur who had normal vision in the day time with glasses of -2.00 D. complained of seeing poorly at night. It was found that by increasing the strength of his glasses to -3.25 he saw very well and without fatigue for prolonged night driving. (3 figures.)

J. Wesley McKinney.

Crawford, J. S., Shagass, C., and Pashby, T. J. Relationship between visual acuity and refractive error in myopia. *Amer. Jour. Ophth.*, 1945, v. 28, Nov., pp. 1220-1225. (5 tables, 2 figures, references.)

Drews, L. C. A new visual-test cabinet. *Amer. Jour. Ophth.*, 1945, v. 28,

Oct., pp. 1138-1140. (2 illustrations.)

Göthlin, G. F. Inheritance of congenital total color blindness with photophobia. *Acta Ophth.*, 1941, v. 19, p. 202.

The author refers to his publication in 1924 on this subject, which gave some indication of the fact that congenital total color blindness with photophobia was probably of a hereditary nature. At that time, however, the literature did not contain a family tree in which this heredity was directly demonstrable. Nettleship's report of 1880 the author does not consider sufficiently reliable, because the family contains in addition amaurotic idiocy and mental defects. It was obvious, however, from the available material that this anomaly was not inherited as a dominant, and if its heredity was recessive it was not sex linked. In the present study the author tabulates the compiled material of this century, which consists of 41 publications, reporting on 41 families, with a membership of 254, and 76 affected members. A report of three family trees, with one homozygotic and one heterozygotic parent, shows a membership of 16, with 9 affected. Statistical analysis of these tables shows that total color blindness with photophobia may be transmitted to future generations. The heredity is recessive and not sex-linked. The author's figures show preponderance of women among those involved; this does not agree with the findings of Nettleship, Peter, and Waardenburg, who found preponderance of men. The author attributes the discrepancy to inadequacy of material at the disposal of the former investigators. Consanguinity among parents was found in 32 or 33 percent of the European families.

Because of sex-linked inheritance of

partial color blindness and the recessive inheritance of total blindness, the type of heredity in an atypical case may determine whether we are dealing with a severe case of partial color-blindness or a mild case of total color-blindness with photophobia.

Ray K. Daily.

Jancke, G., and Holst, A. Influence of heredity and environment on the development of refraction in twins. *Klin. M. f. Augenh.*, 1941, v. 107, Oct., pp. 373-389.

This study is based on the measurement of corneal curvature in 140 pairs of twins (72 single-ovum, 68 two-ovum) and of the total refraction of 60 pairs of twins of each kind. The striking preponderance of concordance of findings in single-ovum twins demonstrates the heredity of refractive states. This is true for hyperopia, emmetropia, and myopia alike, though astigmatism seems to be influenced somewhat by environmental factors. Environmental factors do not produce changes that increase with age. Near-work in no way alters the development of the refractive state even in myopia. School myopia in any genetic sense does not exist. The name "school myopia" indicates coincidence in time only and should be dropped because it is misleading. (6 tables, references.)

F. Herbert Haessler.

Györfy, S. The role of the fluid used for filling contact lenses. *Klin. M. f. Augenh.*, v. 108, May-June, p. 328.

Solutions used for filling the space between a contact lens and the cornea have to fulfill certain physical and chemical requirements. The refractive index must approximate that of the cornea and chamber fluid; i.e., 1.335. Chemically the solution must resemble

the tears in composition and pH, and be isotonic with them. The pH of tears varies between 7.0 and 8.4, and the values in an individual can be established with sufficient accuracy by the use of a colorimetric indicator paper of which a narrow strip is put into the lower cul-de-sac. Several buffer solutions have been advocated, and the required mixtures for the various degrees of pH are given in form of a chart. The pH may change with the length of time a contact lens is worn. Since the gaseous exchange of the cornea is eliminated to a high degree when it is not in contact with the air, a lack of oxygen and increase of CO_2 between contact lens and cornea will result in a shifting of the pH towards the acid side. When plastic contact lenses are used the author frequently noticed a rather sudden decrease of visual acuity which was caused by incomplete wetting of the inner surface of the lens, leaving small dry areas. They are probably caused by peculiar surface tension between the plastic material and the fluid. Certain protein preparations as caseosan, actoprotin and especially lamepon were used satisfactorily in the attempt to lessen the surface tension. (References.) F. Nelson.

Karpe, G. The fitting of spectacle lenses. *Klin. M. f. Augenh.*, 1942, v. 108, Jan.-Feb., p. 80.

The author presents a mathematical and general practical discussion of the general principles of fitting glasses, including measuring of pupillary distances, adjustment of glasses, properly centered and at a proper distance from the corneal vertex. Karpe also discusses in detail the influence of the presbyopic additional near correction on the convergence of the eyes and the prismatic

effect of decentration. Since it is not possible to give an understandable account of the various mathematical calculations without presentation of the accompanying tables and charts it is recommended that one read the article in the original for additional information. (4 figures, 4 charts.) F. Nelson.

Kayser, B. An attack of total color blindness accompanied by sensation of unusual brightness and scintillating scotoma. *Klin. M. f. Augenh.*, 1942, May-June, p. 362.

The author experienced a rare phenomenon consisting of complete sudden extinction of the color perception during the day in a normally lighted room. While all color values disappeared in the faces of three persons with whom he was talking, everything became unnaturally bright. The phenomenon lasted for five minutes and was not accompanied by scintillation. He believes it probable that a vasomotor spasm occurred in identical areas of the subcortical region of the right and the left occipital lobes of the brain. The author also had innumerable attacks of scintillating scotoma during his long life, sometimes 2 or 3 during one day but never accompanied by headaches or vomiting. On one occasion he experienced a colored scintillating scotoma while walking briskly in the dark. Suddenly bundles of fiery colored rays appeared before both eyes shooting upwards like beautiful fireworks. After five minutes the phenomenon disappeared and was not followed by headache or malaise. The vision was not impaired and the phenomenon never recurred.

F. Nelson.

Lisch, K. On the question of the

genesis of myopia. Klin M. f. Augenh., 1941, v. 106, June, pp. 695-699.

In the last five years most oculists have come to believe that myopia is not produced by exogenous factors but congenitally. Recently Lindner has resurrected the old concept of "school myopia" and has suggested that the only way to come to a definite conclusion is to separate single-ovum twins before they go to school so that one may be sent to a village school and allowed to become a peasant while the other is trained for the life of a scholar. This program could hardly be carried out, but Lisch has records of two pairs of single-ovum twins in which the conditions of this experiment were approached though it had not, of course, been planned.

Of a pair of sisters aged 30 years, of peasant stock, one became a seamstress after leaving primary school and the other an agricultural worker. Each developed high myopia which was greater in the right eye—namely, 17.00 and 11.00 D. combined with a small cylinder in the eyes of the seamstress, and 16.00 and 13.00 D. in the agricultural worker.

In each of the other pair of twins a high myopia of approximately equal amount occurred, suggesting a hereditary factor though there was no difference in their environment or activity as required for Lindner's "experiment." (References.) F. Herbert Haessler.

Matas, Carreras. New procedures for the subjective correction of ocular astigmatism. Arch. de la Soc. Hisp.-Amer., 1944, v. 4, Sept.-Oct., p. 733.

This article contains a detailed explanation of the physiologic optics involved in use of the astigmatic dial. The subjective test as used by Matas is based on the mathematical rules applied by Lindner to cylinder retinoscopy. In-

stead of the astigmatic band in the pupil which serves as the indicator in retinoscopy, the blackest line on the dial as seen by the patient serves as indicator in this test. If the axis of the correcting cylinder corresponds exactly to the axis of ocular astigmatism as indicated by the patient, the correction is simple. If, however, the axis of the correcting cylinder deviates from the axis of ocular astigmatism, the two cylinders placed at oblique axes to each other give rise to a new cylinder the axis of which will be somewhere in the acute angle formed by these two axes, and the patient will then see blackest another line, the axis of which will not coincide with the line which he saw blackest originally nor with a line perpendicular to it. The position of this new line, just as the position of the astigmatic band in retinoscopy, indicates the relative strength of the correcting cylinder to the patient's astigmatism, and the direction in which the correcting cylinder is to be moved to coincide with the axis of the ocular astigmatism. This technique, the author claims, has the merit of Marquez's bicylindric refraction, in that it relaxes the ciliary muscle through constant and rapid variation in strength and axis of the cylinder.

Ray K. Daily.

Meitner, H.-J. Peculiar case of anomaly of "blue sense." Klin. M. f. Augenh. 1941, v. 107, Sept., p. 293-301.

Meitner records congenital lack of blue perception in the eyes of a man with otherwise normal findings (except an unspecified refractive error). In the whole color circle blue, blue-violet, and violet were seen as neutral gray. Purple-red was seen as red. Rayleigh's equation was correct and Ishihara's pseudoisochromatic tests normal. On Nagel's charts yellow and blue were

differentiated, the latter being called gray. The case is probably one of atypical tritanomaly. Typical tritanopia could be ruled out. (References.)

F. Nelson.

Mihályhegyi, G. Improvement of visual acuity with contact glasses in the presence of lesions of retina and choroid. *Klin. M. f. Augenh.*, 1942, v. 108, March-April, pp. 200-205.

In seven nearsighted patients with fundus lesions the correction of the refractive error by means of contact glasses gave much greater visual acuity than correction with ordinary lenses, presumably because a contact glass magnifies the image in a myopic eye. (References.) F. Herbert Haessler.

Oberhoff, Kurt. Hyperopic astigmatism and hyperopia in single-ovum twins. *Klin. M. f. Augenh.*, 1941, v. 107, Dec., pp. 577-580.

Oberhoff reports refraction of two pairs of single-ovum twins. The findings are in harmony with the theory that the refractive state is congenital. (3 figures.) F. Herbert Haessler.

Paterson, A., and Zangwell, O. L. Disorders of visual space perception associated with lesions of the right cerebral hemisphere. *Brain*, 1944, v. 67, Dec., p. 331.

The authors describe the case histories of two men who received compound fractures in the right parieto-occipital region. Damage from contusion was minimal. The angular gyri were injured. Of interest are the high grade visual and constructional disabilities which appeared after recovery from the injury. The disabilities were of three main types: 1) Unilateral visual symptoms: impairment of visual perception, relative hemianopia and

disorientation, and a tendency to neglect the left half of visual space. 2) Oculomotor symptoms: abnormalities of oculomotor coördination in reading and other tasks which demand a regular pattern of sequence of eye movements. 3) Visual constructive disabilities: a complex disorder affecting perception, appreciation, and reproduction of spatial relationships in the central field of vision. R. Grunfeld.

Sánchez Mosquera, M. Myopia corrected surgically. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1944, v. 4, July-Aug., pp. 628-630.

Two cases of myopia were operated upon by excision of a strip of conjunctiva 6 or 7 mm. wide all around the limbus and 3 mm. from it. In the first case the myopia was reduced from -1.50 D. each eye to $-.50$ O.D. and $-.12$ O.S. In the second case the myopia was reduced from -1.75 to $-.25$ O.D. and from -4.75 to -3.75 O.S. The mechanism of this lessening of myopia was thought to be a flattening of the anterior segment of the globe by cicatricial contraction in the region of the excised conjunctiva.

J. Wesley McKinney.

Schumann, A rhythmic phenomenon in the field of vision. *Klin. M. f. Augenh.*, 1942, v. 108, Jan.-Feb., p. 97.

The author observed the appearance of a subjective light phenomenon in his visual field which consisted of groups of numerous small stationary red discs of different sizes, and fine scintillating bluish specks. Two pairs of such groups are visible in the visual field of each eye. The phenomenon appears and disappears in rhythmic intervals, increasing for 2-3 seconds, clearly visible for 3-4 seconds, gradually disappearing within 13-19 seconds

and then starting again. The author has been observing this phenomenon for about sixty years and does not think that it is a hallucination. (2 drawings)

F. Nelson.

Sloane, A. E. Refraction clinic. Amer. Jour. Ophth., 1945, v. 28, Nov., pp. 1259-1260.

Strebel, J. Morphology and genesis of posterior sclerectasia in high myopia and the inheritance of myopia. Klin. M. f. Augenh., 1941, v. 107, Aug., pp. 179-193.

Posterior sclerectasia or staphyloma posticum verum must be very rare because in recent discussions of the topic in works like the Kurzes Handbuch the author of the article does not even have an illustration of his own. Strebel refers to the literature and his own early description and now adds eight illustrations which he himself drew from patients in his care.

Most staphylomas are partial but an occasional one is total. Usually they involve the nasal side of the disc, more rarely they are temporal, and the latter are almost always bilaterally symmetrical. The nasal ones are often in the form of multiple terraces on which the vessels descend as cascades. The fundus is usually pale so that the choroidal vessels are visible. The lesion is almost always associated with a disturbance of macular pigmentation and often with other congenital lesions such as cataract and persistent pupillary membrane. Heredity is usually demonstrable.

The pathogenesis of staphyloma as well as the extreme myopia which accompanies it is clear from consideration of the above clinical material. There can be no question of mechanical stretching of the bulbus. The lesion is

purely an inherited degenerative form for which we have to thank our domestication. The author describes the embryologic development of the eye and shows how these lesions may be formed. He points out that belief in purely mechanical factors in morphogenesis, such as for example the theory that invagination of the primary optic vesicle is induced by pressure from the developing anlage of the lens, must be abandoned. All the processes of development result from imminent directives of growth which are controlled by the hereditary constitution of the developing individual.

This leads Strebel to some remarks on his convictions about the hereditary origin of myopia. The extreme degrees which are associated with degenerative changes at the posterior pole of the eyeball are usually fully developed in earliest childhood, and he classifies them as stable. The individuals with the more common and more moderate degree of myopia, which he classifies as labile or dynamic, also inherit the tendency toward nearsightedness, but environmental factors play some part in the amount of myopia which develops. Strebel himself has demonstrated the association of disturbances in calcium metabolism with the development of myopia, and there is evidence that the type of individual that is apt to develop myopia has also a poor development of connective tissues. Pressure of the lids may play a part and so does the tension of the extraocular muscles. Strebel has demonstrated that the asymmetries of the globe are directly proportional to frequency of use of the muscle which lies in the area of deformation. (9 figures, including 3 color plates.)

F. Herbert Haessler.

Sysi, R. Investigation as to the effect

of vitamin B₁ on accommodation. Klin. M. f. Augenh., 1941, v. 107, Sept., pp. 301-306.

A preliminary report on experiments with 26 normal emmetropic individuals, between 26 and 69 years of age, whose range of accommodation was tested before and after injection of vitamin B₁. In younger persons as well as those over 61 years practically no effect was observed. In some persons of pre-presbyopic and presbyopic age a definite increase in range of accommodation could be found within a half hour after injection; and this increase lasted for 24 hours or longer. The effect disappeared gradually within four or five days. The refraction never showed any change during the period of observation. The mechanism is not yet completely explored. (One table, references.) F. Nelson.

Trendelenburg, Wilhelm. Inheritance in a case of anomalous color sense in one and normal color sense in the other eye. Klin. M. f. Augenh., 1941, v. 107, Sept., pp. 280-293.

The patient, a physician, had been examined by Kries more than twenty years previously, when his left eye had been found normal as to color sense, the right deuteranomalous. The unilateral anomaly was congenital. The same condition was found in 1941. No color-sense abnormalities were known in the ascendants. The man's daughter, 17 years of age, was found deuteranomalous in both eyes; and the son, six years old, deuteranopic in both eyes. The children's mother was phenotypically normal but was, of course, a transmitter of deuteranopia. (Bibliography.) F. Nelson.

Tron, E. Posterior principal plane of the optical system of the eye and

significance for refraction Arch. of Ophth., 1935, v. 34, Aug., pp. 107-111.

Measurements were made on 275 eyes to determine the significance of the position of the posterior principal plane on refraction. The radius of corneal curvature was measured with the Javal ophthalmometer. The radii of curvature of the surfaces of the lens, the depth of the anterior chamber and the thickness of the lens were measured with the Tscherning ophthalmometer. The position of the posterior focus and the length of axis were calculated on the basis of the data obtained from these determinations after refraction under atropine cycloplegia.

It was found that the position of the posterior principal plane varied within the limits of 1.06 to 2.51 mm. The average value was 1.63 mm. The position of the posterior principal plane is the same with various types of refraction. The greater the refractive power of the eye and of the lens, the farther the posterior principal plane is situated from the cornea. The length of axis has no effect on the position of the posterior principal plane. A special kind of ametropia was noted in 1.85 percent of the eyes, in which a refractive anomaly resulted from the position of the posterior principal plane in the optical system.

Changes in the position of the posterior principal plane are of no importance for the genesis of anisometropia and changes in both eyes are considerable in isometropia.

John C. Long.

Weber, Ernst. Heredity of refraction on the basis of studies in twins. Klin. M. f. Augenh., 1941, v. 107, Dec., pp. 574-577.

Weber reports the refraction of five pairs of twins, each pair of which certainly or very probably arose from a single ovum. The results confirm Steiger's teachings. Refractive state is a manifestation of growth-regulating factors. Twins with concordant anisometropia particularly suggest that refraction is determined by the constitution of the germ plasm, and not mechanistically. (2 illustrations.)

F. Herbert Haessler.

Wölfflin, E. Trifocal lenses and their application in practice. *Klin. M. f. Augenh.*, 1942, v. 108, Jan.-Feb., p. 95.

Presbyopic people engaged in certain occupations and professions such as librarians, musicians, artists, surgeons, and dentists are sometimes not completely satisfied with simple bifocal glasses. Correction for an intermediate range is often desirable. Wölfflin describes the types of trifocal lenses produced by Bausch & Lomb. (2 drawings.)

F. Nelson.

4

OCULAR MOVEMENTS

Adler, F. H. Effect of anoxia on heterophoria and its analogy with convergent concomitant squint. *Arch. of Ophth.*, 1945, v. 34, Sept., pp. 227-232.

In a previous paper by the author, the existing knowledge of the voluntary and motor mechanisms controlling ocular movements was summarized. The chief source of reflex tone is the visual fixation reflex. All of the other sources of tone, together with the visual fixation reflex, suffice to keep the eyes in alinement with each other. When the visual fixation reflex is artificially eliminated by one means or another and the position of the eyes is measured, one is determining the effect

of all these other sources of tone working together. This is spoken of as the measurement of the muscle balance. One must conclude therefore that heterophoria is an indication that the remaining reflex sources of ocular muscle tone have failed to keep the eyes in perfect alinement when the fusional mechanism is eliminated.

It has been known for some time that under the influence of alcohol there develops an increasing esophoria, which, with increasing loss of the fusional fixation reflex becomes an esotropia. A similar development of esophoria has been found to occur from the effect of anoxia by Velhagen. Since this was contrary to what Berens and Wilmer had previously reported, Adler repeated these experiments.

The experiments reported here were made in a low-pressure chamber. From the data collected he concludes that during the lack of oxygen, there is a shift of the range of fusion toward the convergent position. The range itself shows little change in the normal subject who has a normal range of fusion. If the range is abnormally small to begin with, it may be wiped out altogether, and homonymous diplopia may develop.

The development of exophoria under the influence of alcohol and anoxia is due either to an increase in convergence tone or to a diminution of divergence tone. There is no evidence in the literature or in the data presented here which points strongly to either assumption.

The esophoria produced by alcohol and anoxia, which may even become esotropia, may not be the same as that which occurs in early childhood and which leads to concomitant squint, but there is enough similarity in the two

conditions to suggest study of squint from this point of view. Both are caused by some interference with a supranuclear mechanism.

R. W. Danielson.

Borley, W. E., and Renaud, O. V. Advancement of superior oblique muscle for correction of diplopia. U. S. Naval Med. Bull., 1945, v. 45, Oct., p. 755.

A case of paresis of the superior oblique resulting in 20 prism-diopters of hyperphoria with severe head tilting is presented. The muscle was shortened by Wheeler's method with good results.

Morris Kaplan.

Costenbader, F. D. Causes of failure in the treatment of squint. Amer. Jour. Ophth., 1945, v. 28, Oct., pp. 1123-1131. (1 table, references.)

Gillan, R. U. An analysis of one hundred cases of strabismus treated orthoptically. Brit. Jour. Ophth., 1945, v. 29, Aug., pp. 420-428.

The study of 100 cases of strabismus was undertaken to compare the deviation and the degree of binocular vision present at the conclusion of treatment with that present at the commencement.

Sixty-three cases were treated by orthoptic treatment only. Twenty-three of these became perfectly straight. The original deviations were from 3° to 25° —average 10° . Twenty-five became almost straight, the final deviation being less than 5° . In these cases the original deviations were from 3° to 20° —average 10.35° . Fifteen did not become straight, the final deviation being over 5° . In these cases, the original deviations were from 10° to 30° —average 16.8° . The percentage of

complete success in this group of deviations is 36.5 percent.

Thirty-six of the 63 cases developed good binocular and stereoscopic vision as tested by the synoptophore, cover testing, and Worth's lights. All of these commenced with simultaneous perception and fusion. Seven cases developed fair stereoscopic vision and 20 developed no stereoscopic vision. Of the 23 cases which became straight, all commenced with simultaneous perception and fusion. It would appear, therefore, that the development of orthopsis by means of orthoptic treatment alone depends to a large extent upon the degree of binocular vision present at the commencement of treatment as well as upon the degree of deviation. The possession of simultaneous perception and fusion is an essential prerequisite for success.

Thirty-seven cases were treated by orthoptic treatment plus operation. Six of these became perfectly straight, the average deviations being from 20° - 35° —average 29° . Seventeen became nearly straight, the final deviation being 5° or less, the original deviations being from 15° to 60° —average 33.1° . Fourteen cases did not become straight, the final deviations being over 5° , average original deviation 35.8° .

Of the 100 cases, 25 became fully straight and fully stereoscopic, 20 became almost straight and fully stereoscopic, 26 became straight or almost straight without becoming fully stereoscopic, and 29 became neither straight nor stereoscopic.

In order to meet the criticism that perhaps some of the cases might have become straight without treatment, the results were checked against a series of comparable cases which had no treatment except the wearing of

glasses. In a series of 50 cases under observation for an average of nine months, there was not one in which orthopsis or stereoscopic vision was developed.

Those cases having simultaneous perception and fusion to commence with and developing good stereoscopic vision form the majority of cases becoming straight. It would appear, therefore, that the absence or failure of stereoscopic vision is the chief factor in the causation of concomitant strabismus. Edna M. Reynolds.

Leoz, G. Perverse phenomenon of Bell or of Fuchs. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1944, v. 4, July-Aug., pp. 539-547.

In this case the eyes turned downward instead of upward on forcibly opening the lids. The author discusses the nervous mechanism of the normal Bell's phenomenon.

J. Wesley McKinney.

López Domínguez, Bernabé. Functional and cosmetic results of the treatment of convergent strabismus. *Arch. de la Soc. Hisp.-Amer.*, 1944, v. 4, Sept.-Oct., p. 842.

The surgical pattern followed by López consists of tenotomy of the internus of the nonfixating eye, followed, if inadequate, by tenotomy on the other eye. Slight over- or undercorrections are left alone. Marked undercorrection is dealt with by advancement of the externus of the nonfixating eye. The author has not had a case which required bilateral advancement in addition to bilateral tenotomy. He uses no bandage after tenotomy, but atropine is instilled to abolish accommodation. He does not regard tenotomy as a simple procedure, and reports one case in which severe retrobulbar hemorrhage

compressed the optic nerve and produced blindness of the fixating eye. He finds the result of tenotomy better if the conjunctival incision is horizontal instead of concentric with the limbus. In some cases vertical deviation followed tenotomy. This should be corrected with lenses, lest it interfere with development of binocular vision.

Ray K. Daily.

Marín Amat, M. Inverse Bell's sign. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1944, v. 4, July-Aug., pp. 534-538.

A case is reported wherein the eyes turned directly downward on attempted closure of the lids and in sleep, instead of upward as in the true Bell's phenomenon. A 45-year-old man had a cicatricial ectropion of the left upper lid of five years' duration. The lid border had been drawn up to the eyebrow as a result of an old fistula of the frontal sinus at the orbital rim. There was lagophthalmic keratitis of the upper cornea. In forcible closure of the eyes (impossible of accomplishment in the left eye) and in sleep, the eyes rotated downward so that the corneas were completely hidden by the lower lids. The phenomenon is explained as at first a voluntary protective movement and later an educated reflex pattern. (3 figures, references.)

J. Wesley McKinney.

Moron y Ruiz, José. A controlled suture for muscular advancement. *Arch. de la Soc. Hisp.-Amer.*, 1944, v. 4, Sept.-Oct., p. 839.

For traumatic diplopia due to paralysis of the externus, the author places a loop over each end of the muscle including the conjunctiva, passes the suture through the episclera close to the limbus, and tightens it slowly as the patient fixates a line; when the patient

states that he has no diplopia the suture is tied. In strabismus this suture is inserted, a tenotomy of the antagonist is performed, and the suture tied when the visual lines appear parallel. The writer claims for this suture the advantages of the Lagleyze and Worth sutures, it being as easy to regulate as is the Lagleyze suture, and having as firm a hold on the muscle as the Worth suture. (Illustration.)

Ray K. Daily.

Muck, O. The cause of miners' nystagmus and suggestions for further research in this field. *Klin. M. f. Augenh.*, 1942, v. 108, Jan.-Feb., p. 67.

The cause of nystagmus of miners has not yet been satisfactorily explained. The inadequate illumination, pathologic conditions in the labyrinth, the "unnatural" gaze upwards in narrow shafts as well as the intoxicating influence of various gases in poorly ventilated coal mines are factors which have been suggested by various authors. The inhaling of certain gases (ether, chloroform) exerts a temporary inhibitory influence on different types of nystagmus. Temporary disappearance of central nystagmus has been seen after consumption of alcohol. On the other hand spontaneous nystagmus can be produced by alcohol and veronal. Among the gases most frequently found in coal mines methane may have something to do with the occurrence of miners' nystagmus. However, lack of oxygen sometimes makes nystagmus disappear, and in other instances a miner's nystagmus that had been present underground only reappeared above ground after compression of both jugular veins. Nystagmus can be inhibited by the same agents that are able to induce it. Muck's opinion is that the methods of examination used

by nerve, eye, and ear specialists, which hitherto have been quite different, should be standardized and made uniform in order to establish comparable conditions. He proposes that young men who intend to become coal miners should submit to preliminary tests, wherein they inhale air mixtures from ill-ventilated coal mines in order to find out whether such mixtures are intoxicating to these individuals. (References.)

F. Nelson.

Ohm, J. Optokinetic nystagmus in very dim illumination. *Klin. M. f. Augenh.*, 1942, v. 108, March-April, pp. 187-195.

The author reminds the reader that optokinetic nystagmus is a function of the peripheral retina. Since the nystagmus can be inhibited by placing minute objects that stimulate central fixation before the revolving drum, this procedure may be used as an objective measure of visual acuity. Optokinetic nystagmus induced in dim light, the intensity of which can be measured, may be used as a means of measuring a patient's light sense objectively. He describes the necessary modifications of his older armamentarium, and gives evidence that the method is reliable. (7 graphs, references.)

F. Herbert Haessler.

Ribas Valero, Ramón. Diplopia in paralysis of the vertically acting ocular muscles. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1944, v. 4, July-Aug., pp. 475-533.

This is an exhaustive study of diplopia in vertical-muscle paralysis and does not lend itself to abstracting. (2 diagrams.) J. Wesley McKinney.

Wagman, O. H. Resection of the inferior oblique muscle in hypotropia.

Amer. Jour. Ophth., 1945, v. 28, Nov., pp. 1226-1236. (5 figures, references.)

5

CONJUNCTIVA

Baraff, A. A. **Gonorrheal ophthalmia neonatorum.** Illinois Med. Jour., 1945, v. 87, May, p. 249.

A case of gonorrheal ophthalmia neonatorum is presented which terminated in blindness and which, probably, could have been avoided if the proper therapeutic measures had been instituted. The case, in spite of the state laws, has never been reported to the local health authorities.

R. Grunfeld.

Bernasconi, S. F. **Gonococcic conjunctivitis treated locally with penicillin.** Arch. Chilenos de Oft., 1945, v. 1, Jan.-Feb., pp. 18-19.

The author reports his rapidly successful treatment of bilateral ophthalmia neonatorum in an infant aged nine days. A solution containing 1,000 Oxford units per c.c. was instilled every hour, and the bacteriologic condition was recorded every two hours. In 7½ hours palpebral edema had disappeared and the secretion had become scanty. In 24 hours there was no secretion and the conjunctiva was normal in appearance.

W. H. Crisp.

Bland, J. O. W. **The etiology of trachoma.** Brit. Jour. Ophth., 1945, v. 29, Aug., pp. 407-420.

The two theories of the etiology of trachoma—the virus theory and the rickettsial theory—are not incompatible. Evidence is presented which proves that trachoma is a specific infectious disease, not caused by any cultivable bacterium, but by a filter-

passing agent which is identical with the elementary and initial bodies found in the Prowazek-Halberstaedter inclusions and bearing a close natural relationship to the viruses of inclusion conjunctivitis, lymphogranuloma inguinale, and psittacosis.

The view is advanced that these agents stand in an intermediate position between the rickettsia and the large viruses and may form a biologic link between them. They are classified by the author as basophilic viruses. (Bibliography.)

Edna M. Reynolds.

Chulia, Vicente. **Repair of an extensive posterior symblepharon.** Arch. de la Soc. Hisp.-Amer., 1944, v. 4, Nov.-Dec., p. 1070.

A case of extensive symblepharon between the upper lid and eyeball covering almost the entire cornea was repaired in the following manner: The adhesion was separated; the cornea was cleared as in a pterygium; the conjunctival scar tissue was excised, the bulbar defect next to the cornea was closed by undermining the adjacent conjunctiva, liberating two flaps and bringing them together. The rest of the bulbar defect was covered by a mucous-membrane flap from the mouth. A silver prosthesis was introduced between the lid and the globe. The result was satisfactory. (Illustrations.)

Ray K. Daily.

Dollfus, M.-A. **Value of phlyctenular conjunctivitis in the detection and prophylaxis of infantile tuberculosis.** Arch. d'Ophth., 1941-1942, v. 4, no. 1-2, p. 26.

Dollfus reports 51 cases of phlyctenular conjunctivitis and is convinced of the tuberculous nature of the disease. In his series the tuberculin reaction

was positive in 49 cases and clinical and X-ray examination showed evidence of osseous or pulmonary tuberculosis in all of them. Some of the patients were already under treatment for tuberculosis and the phlyctenulosis appeared to coincide with a recrudescence of the disease. The author recommends that every child with phlyctenulosis have thorough clinical and X-ray examinations as well as a tuberculin test, and that a careful search be made for carriers of the disease in the family.

Phillips Thygeson.

Feigenbaum, A., Michaelson, I. C., and Kornblüth, W. Epidemic keratoconjunctivitis in the Middle East. *Brit. Jour. Ophth.*, 1945, v. 29, Aug., pp. 389-406. (See Section 6, Cornea and sclera.)

Fliri, Adolf. Parinaud's syndrome caused by the virus of infections laryngotracheitis of chickens. *Klin. M. f. Augenh.*, 1942, v. 108, March-April, pp. 176-179.

In the course of a few months the author observed 12 cases of typical Parinaud's syndrome in people working with a flock of chickens afflicted with chicken pest. A veterinarian identified the disease as infectious laryngotracheitis.

F. Herbert Haessler.

Gersh, I., and Reich, N. E. Arthritis, urethritis, and conjunctivitis (Reiter's disease). *Urologic and Cutaneous Rev.*, 1945, Aug., p. 472.

The authors report a case of Reiter's disease exhibiting the triad arthritis, urethritis, and conjunctivitis. Physical examination of a soldier, 19 years of age, revealed bilateral conjunctivitis with a crusted yellow discharge, marked

effusion into both knee joints with moderate pain and stiffness, and a profuse urethral discharge. The urethral meatus was red and pouting. Smears and cultures of the urethral discharge revealed nonhemolytic *Staphylococcus albus*. The conjunctival discharge contained nonhemolytic *Staphylococcus aureus*. The joint fluids were free from organisms. Injection of the urethral discharge into a male guinea pig was followed by the development of a purulent urethritis but by neither eye nor joint involvement. The organism of this urethral discharge was proved to be nonhemolytic *Staphylococcus aureus*, and the authors consider this organism to be the etiology of Reiter's disease.

Neither sulphathiazole nor penicillin proved to be therapeutically effective.

R. Grunfeld.

Jacobson, M., and Levin, N. Epidemic keratoconjunctivitis cured through the combination of penicillin and sulfasuxidene. *New York State Jour. Med.*, 1945, v. 45, Sept. 15, p. 1990. (See Section 6, Cornea and sclera.)

Lijó Pavía, J. Burn of the cornea and conjunctiva. How to prevent symblepharon. *Rev. Oto-Neuro-Oft.*, 1944, v. 19, Nov.-Dec., pp. 159-171.

The paper is prefaced by a very complete discussion of the views of other writers. The substances most commonly causing corneal and scleral burns are lime, ammonia, acids, and hot or molten metals. The degree of reaction depends on the severity of the burn. The results from this type of burn are hyperemia and edema, cauterization, necrosis, granulation, and finally cicatrization with adhesions.

A young adult suffered a severe

burn of the lids, cornea, and conjunctiva, from flaming naphtha. After immediate and abundant irrigation and local anesthesia, a mold of surgical "Korina" (amidoazotoluol) at a temperature of 45° to 47°C., was placed in the eye over the cornea, extending to both fornices. Atropine ointment was added. After 11 to 13 days sufficient healing and epithelization had occurred to allow removal of the mold. No permanent adhesions formed. Vision remained at 0.3. The author prefers this mold and atropine ointment to mucous graft, interposition of rabbit peritoneum, or contact lens. (7 illustrations, references.) Edward Saskin.

Lucas, R., and Weiss, H. **Gonorrheal syndrome without gonorrhea.** *Arch. of Ophth.*, 1945, v. 34, Aug., pp. 97-98.

The triad of urethritis, conjunctivitis, and arthritis, occurring in this order, in the absence of a gonococcic etiology, is known as Reiter's disease. The anterior and posterior urethra are involved and often the bladder. The symptoms are so similar to those of gonorrhea that suspicion of the gonococcus is difficult to dispel. An acute purulent conjunctivitis is a constant finding. A tendency to spontaneous recovery without corneal ulceration is the rule. Keratitis and iritis often occur. Chronic arthritis is usually the cause of the severest complaint. The arthritis involves more than one joint and clears up in from one to five months without ankylosis. Cutaneous lesions may be simple erythemas, urticarial or erythema-nodosum-like eruptions, hemorrhagic and vesicular eruptions or hyperkeratitic lesions. The disease cannot be distinguished from gonorrhea clinically. Failure to demonstrate the gonococcus is the differentiating

feature. The condition does not respond to penicillin or sulfadiazine nor to any other known specific remedy. Complete recovery is the rule.

The authors report a case of Reiter's disease in a 29-year-old man developing 10 days after exposure. An acute urethritis developed first and was followed in three weeks by a severe purulent conjunctivitis. Arthritis of the toes, fingers, wrist, heel, and knee developed. Coincident with the arthritis a cluster of superficial vesicles were noted in the center of each cornea. Iritis with keratitic precipitates developed in each eye. Hemorrhagic vesicular cutaneous lesions appeared. Within two months all symptoms had gone. Administration of sulfathiazole and penicillin had no positive effect on the disease. Repeated conjunctival and urethral smears, as well as urethral, blood, and synovial-fluid cultures were all negative for the gonococcus.

John C. Long.

Paez Allende, Francisco. **Concerning a case of diffuse neurofibromatosis of the bulbar conjunctiva (Recklinghausen's disease) with skeletal and cutaneous manifestations, asymmetry of the body and intracranial involvement.** *Arch. de Oft. de Buenos Aires*, 1943, v. 18, Sept., pp. 438-453. (See *Amer. Jour. Ophth.*, 1945, v. 28, Aug., p. 933.)

Poleff, L. **The real value of treatment by sulfonamides in trachoma.** *Ophthalmologica*, 1943, v. 105, March-April, pp. 156-174.

After reviewing the literature on the subject the author expresses the opinion that sulfanilamide acts in trachoma through bacteriostasis with subsequent destruction of the virus by phagocytosis. The drug has no resorbing

effect on the follicles and is, therefore, not a cure-all for trachoma. While it is of great value in clearing the infection and the corneal complications, it should be used only in conjunction with local therapy. Based on the observation of 1,050 cases of trachoma in Morocco the author recommends vigorous massage treatment of the conjunctiva with glass or silver stick for several months, eventually preceded by an expression of the follicles. During the same time sulfonamides are given by mouth. It is only in very early cases with little formation of follicles that sulfonamides alone may be sufficient. In the fully developed cases the combined treatment is the method of choice and will arrest the average case in three months. Sulfanilamide effects a sterilization of the infection and is the best precaution against recurrences. (Bibliography) Max Hirschfelder.

Rössler, F. The treatment of trachoma with cold applications. *Klin. M. f. Augenh.*, 1942, v. 108, May-June, p. 365.

Davids has reported that application of snow or ice to the trachomatous conjunctiva has a healing influence on the inflammatory process but Rössler had published the results of such experiments carried out in 1912. They were not encouraging. Though it is well known that cold applications reduce the acute irritation of a fresh case of trachoma, this does not mean that such applications can heal the disease. F. Nelson.

Schmelzer, H. Allergic conjunctivitis and pervitin. *Klin. M. f. Augenh.*, 1942, v. 108, March-April, pp. 179-184.

In two patients with characteristic allergic conjunctivitis in the course of hay fever, a variety of the usual

symptomatic remedies failed to give relief. There was an immediate favorable response to pervitin, a drug whose structural formula resembles benzedrine and ephedrine. (References.)

F. Herbert Haessler.

Sorsby, Arnold. Local penicillin for ophthalmia neonatorum. *Brit. Med. Jour.*, 1945, June 30, p. 903.

Results of local penicillin therapy in 38 cases of ophthalmia neonatorum are described. The drug was used in a concentration of 2,500 units per c.c. Thirteen cases were treated with instillations at intervals of one hour for six hours, then of two hours for 24 hours, and subsequently of three hours. All cases responded well with clinical cures in from 4 to 60 hours. Twenty-five cases were treated with instillations every five minutes until pus formation ceased, then every half hour until the eye was dry, every hour for 12 hours and every two hours for 24 hours. In two cases the response was poor but gratifying in all the others; clinical cure occurred in 38 hours at the longest and 25 minutes at the best with an average of ten hours. Infections with gonococcus, staphylococcus, streptococcus, Morax-Axenfeld and diphtheroid bacillus and inclusion blennorrhea were treated. The type or severity of the infection had no bearing upon the results. During this regimen no irrigations after an initial one are necessary as pus formation ceases within one-half to three hours. No untoward reaction to the penicillin was noted.

Morris Kaplan.

Vetter, J. Atypical cases of epidemic keratoconjunctivitis. *Klin. M. f. Augenh.*, 1942, v. 108, Jan.-Feb., p. 51. (See Section 6, Conjunctiva.)

6

CORNEA AND SCLERA

Atkinson, W. S. Interstitial keratitis treated with subconjunctival injections of penicillin. *Arch. of Ophth.*, 1945, v. 34, Sept., p. 233.

The author reports the case of a 27-year-old man who developed interstitial keratitis in spite of antiluetic treatment. He was given seven daily subconjunctival injections of 0.5 c.c. of sodium penicillin (1,000 Oxford units of penicillin per c.c.) The signs and symptoms subsided rapidly. Two months later when the patient was last seen, the vision was 20/15 and the eye was quiet. R. W. Danielson.

Bashoff, P. H. The results of corneal transplantation and plastic operations. *South African Med. Jour.*, 1945, v. 19, June 23, p. 209.

The author describes 30 cases of keratoplasty. In the first nine cases he made transplants according to the methods of Filatov and Weiner with formalin-treated tissue. Results obtained were negligible to bad. In the next 17 cases 2-mm. auto transplants were taken from the clear portion of the recipient's corneas after the method of Morax. Results were good in 13 of the 17 cases. The reaction of the cornea to the graft of its own tissue was very slight. The last four patients had keratoconus and were treated according to the Webster Fox operation. An elliptical segment was removed from the cornea just below the pupil and the edges approximated by sutures. The cone was thus flattened and any apex scar moved below the pupil; the resulting irregularity of the whole cornea was obviated by the contact lens subsequently fitted. The final results

in these cases were quite satisfactory. Morris Kaplan.

Bischler, V. The different forms of metallic impregnation of the cornea. *Arch. d'Ophth.*, 1941-42, no. 3-4, v. 4, p. 114.

The case of a silversmith is presented. The right cornea showed a ring of the Kayser-Fleischer type, the left cornea an identical change except for the fact that it involved the entire extent of Descemet's membrane. An unusual feature of the case was that dark adaptation was markedly diminished. Pseudosclerosis and impregnation of the cornea with salts of gold and copper could be excluded and a diagnosis of professional argyrosis of the cornea established. The biomicroscopic appearance is given in detail, but the accompanying illustrations are poorly reproduced. A complete review of the subject of metallic impregnation of the cornea precedes the case report.

Phillips Thygeson.

Cogan, D. G., and Grant, W. M. Keratitis due to n-butyl alcohol. *Arch. of Ophth.*, 1945, v. 34, Sept., pp. 248.

This additional information should be read in conjunction with a paper published by the authors in the *Arch. of Ophth.*, 1945, v. 33, Feb., p. 106. For abstract see *Amer. Jour. Ophth.*, 1945, v. 28, Aug., p. 935.

Edeskuty, Otto. Ichthyosis of the cornea. *Klin. M. f. Augenh.*, 1942, v. 108, March-April, pp. 170-176.

Congenital ichthyosis is rarely complicated by a corneal lesion. The author describes a patient with congenital ichthyosis in whom there were corneal lesions which he believes to be manifestations of the patient's congenital

defect. He found descriptions of four similar cases in the literature. The corneal lesion consists of subepithelial opacities in the superficial layers of the central area of the cornea. The opacity is nodular; there are proliferation of blood vessels and great photophobia without objective signs of irritation. An accompanying conjunctival inflammation with papillary hypertrophy may be an essential part of the disturbance. The lesion is differentiated from Groenow's nodular corneal dystrophy by the absence of corneal opacity in the deeper layers. The confluence of the opacity suggests a disciform lesion. (References.) F. Herbert Haessler.

Feigenbaum, A., Michaelson, I. C., and Kornblüth, W. Epidemic keratoconjunctivitis in the Middle East. *Brit. Jour. Ophth.*, 1945, v. 29, Aug., pp. 389-406.

Three hundred and eighty one cases of epidemic keratoconjunctivitis occurring between 1938 and 1944 are reported. The epidemic occurred at the beginning of the rainy season. Trauma was found to play a considerable role in the etiology of the disease.

The incubation period appeared to be between five and fourteen days. The incidence of the disease was not affected by age, sex, or social class. No recurrence was observed, but there were exacerbations when the disease was protracted.

The subjective symptoms consisted of prickling, itching, and sensation of a foreign body in the eye, later followed by slightly blurred vision. The objective findings were lacrimation, swelling of the lids, pseudoptosis, a typical glistening of the conjunctiva (cellophane-surface appearance), marked swellings of the conjunctiva of the

lower lid which were sometimes cocks-comblike, swellings of the plica semilunaris and caruncle, and painful swelling of the preauricular gland, often accompanied by swelling of the submaxillary gland. Especially notable was a delicate fibrinous, threadlike secretion, such as is commonly found in spring catarrh. Conjunctival smears and cultures were negative.

The condition began bilaterally in 50 percent of the cases.

The corneal lesions were found to be of three different types: (1) ill-defined subepithelial dots, (2) superficial epithelial infiltrates some of which were vesicular and some of which stained, (3) disciform keratitis. Corneal changes were found in 60 percent of the cases and appeared from seven to seventeen days after the conjunctival changes.

The conjunctival changes gradually diminished after a few weeks, while the corneal complications persisted from a month to two and one-half years.

Energetic treatment with silver and copper salts was found to aggravate the condition. The best treatment was frequent instillation of concentrated adrenalin solution (1: 4,000) and douching with cold water. After the complete disappearance of the conjunctival changes, 2-percent yellow oxide of mercury ointment with 5-percent dionin were useful for the corneal infiltrations. Sulfonamide, locally or by mouth, did not help the condition and penicillin had no effect whatsoever. In a few cases of disciform keratitis, intravenous injection of 1 to 3 c.c. of a 10-percent solution of sodium iodide brought about rapid improvement.

Experiments with rabbits confirmed the specific nature of the causal agent.

Tissue cultures and filtration experiments showed this to be a filtrable virus. Mice could not be infected.

Immune bodies were shown to be present in the blood of convalescent human beings.

Histologic examination of human conjunctival tissue showed flattening of the epithelium, marked capillary dilatation and edema in the subepithelial tissue, and infiltration with lymphocytes and large mononuclear cells with multiple mitoses. In the chronic cases, there was marked papillary hypertrophy. (4 graphs, 3 photographs, 11 microphotographs, references.) Edna M. Reynolds.

Garibay, C., and Cortés Zavala, A. **Keratitis nodosa due to caterpillar hair.** *Anales Argentinos Oft.*, 1944, v. 5, Oct.-Nov.-Dec., pp. 136-138.

A young adult male felt a sharp pain in his right eye and brushed a "hairy worm" from his lids. For two months he was treated by a general physician before consulting an oculist. At this time he had edema of the upper lid, photophobia, lacrimation, conjunctival congestion, superficial punctate corneal lesions, and iritis. Slitlamp examination revealed nodular infiltration of the cornea with a fine reddish hair occupying the center of each nodule. Following extraction of the caterpillar hairs the patient was much relieved. However, intraocular infection supervened, due either to corneal perforations by the hairs, or some venom thereof. At last examination the eye was atrophic and enucleation seemed advisable. Edward Saskin.

Harley, R. D., and Kaiser, R. F. **Keratitis associated with malaria.** *Amer. Jour. of Ophthal.*, 1945, v. 28, Dec., pp. 1309-1312.

Jancke, G. The uniformity of epidemic forms of keratoconjunctivitis described under different terms from 1889-1941. (*Keratitis punctata, nummularis, maculosa epidemica*, etc.) *Klin. M. f. Augenh.*, 1942, v. 108, Jan.-Feb., p. 39.

First described by Fuchs during an epidemic in Vienna in the years 1885 to 1890 under the name *keratitis punctata superficialis*, apparently the same or a very similar disease was reported during the same epidemic by Stellwag, Reuss, and Adler who named it *keratitis nummularis, keratitis maculosa*, and *keratitis subepithelialis centralis*, respectively. Later other names were added. Jancke believes that these seemingly different diseases are manifestations of the same disease, an epidemic keratoconjunctivitis which spreads in waves at varying intervals over large areas. For all these related types he proposes the uniform term *keratoconjunctivitis nummularis epidemica*. (Bibliography) F. Nelson.

Jacobson, M., and Levin, N. **Epidemic keratoconjunctivitis cured through the combination of penicillin and sulfasuxidine.** *New York State Jour. Med.*, 1945, v. 45, Sept. 15, p. 1990.

The authors publish their observations of a patient who had epidemic keratoconjunctivitis for three months. He had marked hyperemia of the palpebral and bulbar conjunctivas, tearing, photophobia, and opacities of the cornea. The patient showed remarkably fast response to combined sulfasuxidine and penicillin. Theodore M. Shapira.

Lijó Pavía, J. **Burn of the cornea and conjunctiva. How to prevent symblepharon.** *Rev. Oto-Neuro-Oft.*, 1944, v. 19, Nov.-Dec., pp. 159-171. (See Section 5, Conjunctiva.)

Purtscher, Ernst. Crystalline deposits in the cornea after lime burn. *Klin. M. f. Augenh.*, 1942, v. 108, May-June, p. 357.

The author reports one case of severe lime burn which resulted in complete destruction of the bulbar conjunctiva and corneal epithelium and almost complete degeneration of Bowman's membrane. After 10 days numerous chalky-white concretions of various sizes appeared in the corneal parenchyma of which the smaller ones were spherical, and the larger ones irregularly polygonal or quadrangular. Five weeks after the accident the perforation of the cornea increasing pain, and loss of all function led to enucleation. Histologic examination revealed that the corneal lamellae were separated by hyaline bodies which were stained faintly pink with eosin and hematoxylin. It is assumed that these formations were organic calcium compounds. (1 drawing, 1 microphotograph, references.)

F. Nelson.

Reca, Arturo. Neuroparalytic keratitis. *Anales Argentinos de Oft.*, 1944, v. 5, July-Aug.-Sept., pp. 90-91.

The author discusses a case of surgical destruction of the Gasserian ganglion performed for the relief of a trigeminal neuralgia. Keratitis developed about two months after operation, with typical trophic and inflammatory reaction. Treatment consisted of warm compresses, atropine, dionine, sulfa solutions, and protein injections. No statement is made as to relief or recovery.

Edward Saskin.

Rosen, E. Megalocornea. *Amer. Jour. Opthth.*, 1945, v. 28, Dec., pp. 1352-1359.

Vetter, J. Atypical cases of epidemic keratoconjunctivitis. *Klin. M. f.*

Augenh., 1942, v. 108, Jan.-Feb., p. 51.

The author briefly reports cases of epidemic keratoconjunctivitis in which a recurrence of the disease resulted in extensive and deep ulceration of the cornea with considerable loss of vision. In one case the vision had already been greatly diminished because of a bilateral disseminated choroiditis. (6 figures, 1 reference.)

F. Nelson.

7

UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Arjona, J. Expulsive hemorrhage. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1944, v. 4, Nov.-Dec., p. 1031.

Arjona reviews the literature and illustrates with microphotographs the vascular lesions in his own case. These show an inflammatory lymphocytic infiltration around the choroidal vessels. He concludes that the basic cause of an expulsive hemorrhage is an inflammatory or arteriosclerotic disease of the blood vessels, particularly of the ciliary vessels. The sclerosis may be a part of a general arteriosclerosis, or a purely local lesion; or it may be a sclerosis due to an undiagnosed glaucoma which leads to a vascular fragility and inability to withstand the increased vascular pressure which comes with the sudden drop of the intraocular pressure when the eyeball is opened. As a prophylactic measure the author urges careful examination for latent glaucomatous processes through provocative tests and tension curves; if discovered they should be controlled by preliminary iridectomy or miotics. When general hypertension cannot be reduced by medication, a venesection immediately before the operation is advised. After the loss of one eye from an expulsive

hemorrhage the operation on the other eye should be preceded by the administration of calcium chloride, coagulants, and vitamins C and K. The cataract extraction in such cases should be extracapsular, leaving the posterior capsule with its ciliary attachment intact. After an expulsive hemorrhage has occurred early enucleation will spare the patient unnecessary pain and the hazard of sympathetic ophthalmia. Filatov's proposal of a prophylactic and curative scleral trepanation at the equator is mentioned; the author had no experience with it, but it appears to him that it is impractical and ineffective. (3 illustrations.) Ray K. Daily.

Appel, Hans. Bilateral hypochromia (Fuchs's heterochromia) and signs of status dysraphicus. *Klin. M. f. Augenh.*, 1942, v. 108, March-April, pp. 166-169.

Appel describes the eyes of a patient in whom there was a hypochromic iris complicated by postcorneal deposits, turbid aqueous, and cataract in each eye, but without synechiae. Fuchs had already mentioned that complicated heterochromia might occur in both eyes but never observed a case. Since then eight observations have been published. Appel describes another case of bilateral hypochromia observed at the Freiberg Clinic earlier. The heterochromia was complicated by glaucoma, which is not uncommon. The patient also had several manifestations of status dysraphicus, which are considered signs of early syringomyelia. (References.) F. Herbert Haessler.

Castañé Decoud, D. D'A. de. Choroidal melanomas. *Anales Argentinos de Oft.*, 1944, v. 5, Oct.-Nov.-Dec., pp. 123-135.

The paper presents an evaluation of the study of 17 cases of choroidal

melanoma in the past ten years. Eleven cases are discussed, with macro- and micropathology described. A well-developed table of conclusions is included. (1) This condition represents but 0.05 percent of all eye cases; (2) it occurs mainly in the fifth to seventh decades of life; (3) it is most commonly situated at the equator and anterior choroidal segment; (4) patients have lived for from two to ten years after enucleation; (5) the tumor is round, circumscribed, enveloped by melanophores, and has an almost true membrane; and (6) the most common cellular types of tumor are roundcell and fusiformcell, with an occasional mixed-cell. (11 illustrations, 1 table.)

Edward Saskin.

Goedbloed, J. Mode of inheritance in choroideremia. *Ophthalmologica*, 1942, v. 104, Dec., pp. 308-315.

Three cases of choroideremia within the same family are described. From the mode of inheritance in this family as well as from the reports in the literature the author concludes that the condition shows an intermediate gonosomal heredity. Men who are affected always show a true choroideremia. Their sons are normal, but their daughters will have a pepper and salt fundus.

Max Hirschfelder.

Hudelo, Guillaumat, and Maussion. Traumatic arciform choroiditis. *Arch. d'Ophth.*, 1945, v. 5, no. 1, p. 44.

Four cases of severe contusion of the globe in which choroidal tears resulted are reported. All four cases had in common an absence of hemorrhage and an apparent late development of the lesion. In the first case it was not possible to make a definite diagnosis until two months after the traumatism, while in the second the typical ophthal-

moscopic picture developed at the time of the second examination. In the third case the fundus appeared normal until the sixth day and the tear became visible four days later. The fourth case had an apparently normal fundus until two weeks after the injury when a typical juxtapapillary tear with degeneration of the macula was seen.

After a review of 33 cases reported in the literature the authors conclude that the lesion is not an actual tear but a traumatic necrosis of the choroid. In support of this opinion they note the late appearance of the so-called tear, the absence of the hemorrhage which would be inevitable if an actual rupture occurred, and the usual absence of edema.

Phillips Thygeson.

Saggesse, D. A., and Decoud, A. C. Conglomerate tuberculoma of the choroid. *Anales Argentinos de Oft.*, 1944, v. 5, July-Aug.-Sept., pp. 84-89.

In a child two and a half years of age a diagnosis of typical glioma of the left eye was made at the first examination. A yellow-white tumefaction in the vitreous cavity extended from behind the lens to the fundus. The right eye was normal. Enucleation was advised, but a month elapsed before operation. During this time the vitreous mass had become somewhat smaller and several scleral plaques or nodules had appeared. The Mantoux reaction was strongly positive.

After enucleation microscopic examination revealed typical giant and epithelioid cells, lymphocytic infiltration, and several adjacent similar choroidal follicles. Final diagnosis was tuberculoma.

Differential diagnosis requires careful ophthalmoscopy, history, serologic and radiologic study, and frequent re-examinations. The treatment of ad-

vanced cases is enucleation, provided the sclera is intact. (Bibliography.)

Edward Saskin.

Stock, W. Chronic uveitis, its etiology and treatment. *Klin. M. f. Augenh.*, 1942, v. 108, May-June, p. 257.

Since Stock produced a typical nodular iritis, iridocyclitis and choroiditis in animals by introducing tubercle bacilli into the blood stream, it has been recognized that a certain number of cases of chronic uveitis in men are tuberculous in origin. However, Stock does not think that all cases of nodular chronic uveitis are tuberculous since any type of chronic infection that is spread through the blood stream can produce nodules. The clinical course of a chronic uveitis is not characteristic for one particular infection. The only data that give a certain amount of safety in diagnosing chronic uveitis are a tuberculin test and the effect of subsequent treatment. A definite focal reaction in the affected eye during the time of general reaction to one milligram of old tuberculin injected intracutaneously indicates that the eye is also suffering from an active tuberculous process. A thorough general examination of the patient is essential including fluoroscopy, sedimentation rate, dental examination and Wassermann reaction. If the patient has a normal temperature for three consecutive days the tuberculin test is made routinely. Though many patients have a positive reaction locally, a focal reaction in the eye is seen in only about 20 percent of these cases. In the latter cases X-ray treatment is administered immediately (20 percent s.e.d. = 100 r.). If after the X-ray treatment a slight ciliary injection, cloudiness of the chamber fluid and pains occur the prognosis is good. Some cases heal completely after one

treatment. If the treatment is followed by improvement but not complete recovery a second dose is given after six weeks. This interval is chosen because a delayed reaction sometimes occurs after four weeks. Stock has never seen any detrimental effect from the X-ray treatment. In more than 1,000 patients there was not a single case of roentgen cataract and often there was a definite decrease of the tension in eyes with secondary glaucoma. All cases of chronic uveitis which react this way are tuberculous. When the tuberculin reaction is negative the patient is given 10 c.c. of atophanyl intravenously daily. When the lesion responds to this treatment it is regarded as rheumatic. Atophanyl is also very helpful in sympathetic ophthalmia. Local treatment is given as usual.

There remain some patients who respond neither to irradiation nor to atophanyl but relatively well to eubasin or cibazol. In these cases one of the cocci is probably the etiologic agent. Stock does not favor sending patients to mountain sanatoria for climatic treatment. Most of his patients with severe chronic uveitis come from the Black Forest and relatively few from the northern plains. He prefers to send such patients to the sea shore.

F. Nelson.

Vidal, F., and Malbrán, J. Studies on the chemical composition of the aqueous humor of the cat. 5. Glucose. Arch. de Oft. de Buenos Aires, 1943, v. 18, Aug., p. 405.

The authors present tables showing the glucose content of the aqueous humor of the cat. They found a lower concentration of glucose in the plasmod aqueous than in the primary aqueous. They confirmed the increase of glucose values in the aqueous humor

after nervous excitement and the intravenous injection of adrenalin. (Bibliography.)

Plinio Montalván.

Vidal, F., and Malbrán, J. Studies on the chemical composition of the aqueous humor of the cat. 6. Ascorbic acid. Arch. de Oft. de Buenos Aires, 1943, v. 18, Sept., pp. 454-463.

The authors present their findings concerning the ascorbic acid (vitamin-C) content of the aqueous humor of the cat, which proved to be lower than in other animals, including man. Contrary to the report of other observers, the authors found no difference between the ascorbic-acid contents in primary aqueous humor and the aqueous humor of second formation. (Bibliography.)

Plinio Montalván.

8

GLAUCOMA AND OCULAR TENSION

Bloomfield, S., and Lambert, R. K. The lability of ocular tension. Arch. of Ophth., 1945, v. 34, Aug. pp. 83-96.

Detailed tests were conducted to determine the effect of sudden increase in arterial pressure on the intraocular pressure in both normal and glaucomatous eyes. The increase in vascular pressure was produced by immersion of the hand in cold water. The vascular and intraocular-pressure response to cervical compression was also studied. The intraocular-pressure and vascular-pressure response to simultaneous cervical compression and cold immersion was also tested. The changes in intraocular pressure encountered were not great but were of significance.

The authors concluded that the normal maintenance of intraocular pressure within an optimum range suggests the presence of a regulatory mechanism. Dysfunction of such a hemostatic

system may result in abnormal lability of intraocular pressure and may eventuate in chronic simple glaucoma. The method of cold stimulus plus cervical compression to test lability may prove of value for the earlier diagnosis of chronic simple glaucoma and the evaluation of therapeutic measures for that disease.

John C. Long.

Brausewetter-Koppner, G. Comparison between trephining (Elliot) and iridencleisis (Holth). *Klin. M. f. Augenh.*, 1942, May-June, v. 108, p. 303. (See Section 2, Therapeutics and operations.)

Duverger, C., and Bregeat, P. Cataract and chronic glaucoma. *Arch. d'Ophth.*, 1945, v. 5, no. 1, p. 3.

Cataract and chronic glaucoma may occur independently in the same eye, and there is a real danger that the symptoms of the glaucoma may be masked by the cataract which prevents recognition of optic-nerve excavation. Signs which should suggest glaucoma include abnormal dilatation of the pupil, intraocular pressure above 25 mm. Hg, and contraction of the light field, particularly on the nasal side. Distinction must be made between chronic glaucoma and temporary hypertony due to an intumescent lens. The authors recommend an inferior limbal section for cataract extraction in order to conserve the area of the upper limbus for a possible fistulizing procedure. Extracapsular extraction is recommended both for its safety and for the value of the intact posterior lens capsule in preventing the complication of vitreous prolapse into the fistula. The cataract extraction precedes the glaucoma operation, which is a slightly modified Lagrange procedure if the cataract is mature and if the visual field

is good and the hypertony can be controlled by miotics. The glaucoma operation is done first if the visual field is markedly contracted or the hypertony does not respond to miotics.

Phillips Thygeson.

Gradle, H. S. Fundamental ideas in surgical treatment of glaucoma. *Arch. Chilenos de Oft.*, 1945, v. 1, Jan.-Feb., pp. 5-11.

Practically all the measures taken to lower intraocular hypertension attain their purpose by establishing drainage of the aqueous humor. This may be done by restoring the normal drainage channel, opening new intraocular channels, or establishing new extraocular pathways for carrying off the aqueous. Each operation has definite indications. The results of surgical intervention depend on the oculist's diagnostic skill, and on his knowledge and understanding of pathologic changes and of the modus operandi of the various procedures, as well as their operative technique. In a general way, it may be said that 95 percent of cases of glaucoma can be controlled provided that they are not seen too late and that a judicious surgical plan is followed.

W. H. Crisp.

Lehrfeld, L. Revaluation of Herbert's flap operation for glaucoma. *Arch. of Ophth.*, 1945, v. 34, Sept., pp. 191-194.

Herbert's original trapdoor or flap operation, devised initially for absolute glaucoma, had, as its basic principle, the drainage of fluid from the interior of the eyeball through an opening in the sclera, in the anterior segment, to the subconjunctival space. Using a narrow Graefe knife, he made an incision in the sclera 2 mm. from the corneal margin in the lower outer

quadrant of the globe. From the two ends of this small incision, two shorter forward cuts were made to the limbus by turning the edge of the same narrow blade forward and sawing carefully to avoid puncturing the iris, in the emptied anterior chamber. He thus created a small rectangular flap or tongue of corneoscleral tissue, which was cut subconjunctivally with its base at the limbus.

Lehrfeld still advises enucleation of all painful blind eyes associated with increased intraocular pressure, but when the patient refuses enucleation, this operation may be tried. He has operated upon the eyes of seven patients of this nature with quite satisfactory results.

If the origin of acute glaucoma is in the vitreous-chamber segment, it seems logical that the new exit of fluids should be made in the silent portion of the eyeball, rather than at the corneal margin. The same holds true for chronic simple glaucoma which has as its basic pathologic conditions arteriosclerosis and fibrosis of the tissues of the eyeball. If one holds to the theory that the canal of Schlemm is so sclerosed and fibrotic that it no longer serves as exit for these fluids then the new exit for these fluids should not be in the obstructed angle, but in the silent areas of the eyeball.

Herbert originally made his anterior sclerotomy 1.5 mm. from the limbus. Later he increased the distance to 2, 3, and 4 mm. Lehrfeld's contribution to the Herbert operation is a further shifting of the exit in the sclera 4 to 8 mm. from the limbus, producing a trapdoor in the region of the eye corresponding to the location of the ciliary body and immediately beyond.

The operation can be repeated at different locations should increased ocular tension return. R. W. Danielson,

Lijó Payá, J. Anterior hemorrhagic glaucoma. *Rev. Oto-Neuro-Oft.*, 1944, v. 19, Oct., pp. 134-140.

This diagnosis is reserved for the secondary glaucoma that follows partial or total occlusion of the central retinal vein or its tributaries, which is associated with rubeosis iridis; which accompanies diabetes with hemorrhages; and which follows massive vitreous or retinal hemorrhage. The author quotes the opinions of other writers as to what data are necessary for such a diagnosis.

The case of a young adult is presented who suffered a trauma to his left eye some years earlier, following which a cataract developed. Vision was reduced to light perception. After a long period of quiet, he suddenly experienced severe pain in the same eye. Examination revealed corneal edema, hyphema of 4 mm., a dilated pupil, and a tension of 80 mm. (Schjdtz). Under pilocarpine 3 percent, and general care, the tension was brought to normal in one month, with no recurrence of corneal edema, and a recession of the hyphema to 2 mm. Rubeosis iridis was also present. After a second month of treatment the hyphema was completely absorbed. The author concludes that anterior hemorrhagic glaucoma is due to mechanical obstruction of the iris angle, since miosis hastens absorption of the attendant hyphema and restores a normal ocular tension. (3 retinographs, references.)

Edward Saskin.

Radnet, Magda. Eye findings in Cushing's disease. *Ophthalmologica*, 1942, v. 104, Dec., pp. 301-307. (See Section 17, Systemic diseases and parasites.)

Stocker, F. W. Response of chronic simple glaucoma to treatment with

cyclodiathermy puncture. Arch. of Ophth., 1945, v. 34, Sept., pp. 181-186.

Two types of diathermic treatment have been recommended for glaucoma. Weve, followed by Amsler, was first to use the surface electrode. The perforating type, called cyclodiathermy puncture, was introduced by A. Vogt.

In the beginning Stocker used cyclodiathermy puncture only in desperate cases of glaucoma which had been unsuccessfully treated by several of the various surgical procedures. However, as the author's own experience grew he became more and more convinced that the technique of cyclodiathermy puncture could be so refined as practically to exclude most of the dreaded unfavorable side and after effects. He therefore treated with cyclodiathermy puncture a group of Negroes suffering from chronic simple glaucoma, who had not been previously subjected to any other operation and who ordinarily respond poorly to filtering operations.

Vogt's original idea was to destroy the ciliary body with its processes directly with the coagulating diathermic current. However, when the punctures were applied near the limbus where they reached the corona ciliaris, there was too much reaction, and even necrosis of the cornea occurred. It was found that when cyclodiathermy puncture was applied farther back, to the pars plana of the ciliary body, an adequate lowering of the tension resulted. It must be assumed that by destroying the blood vessels, which are supplied by the long posterior ciliary arteries and reach the corona ciliaris by passing through the pars plana, the circulation of the corona ciliaris becomes impaired to a point at which degeneration and atrophy results. This obviously should ultimately lead to a decrease in

the production of intraocular fluid.

The author recommends close adherence to the technique as outlined. He says, "Vogt's needle, 0.5 mm. long and 0.18 mm. in diameter, or the shortest type of Kronfeld needle may be satisfactory. More recently I have been using exclusively a needle that has been made according to my own suggestions. It is better insulated and may be recommended. Very little current should be used. Vogt used to recommend 60 milliamperes. However, I found that it was not practical to rely on a milliampere meter and that it was necessary to determine at the beginning of the operation how much current is necessary just to produce coagulation on the surface of the sclera. Usually the Walker machine is set between 15 and 20.

"The question then arises how many punctures should be made and how large an area has to be covered. An area beginning from 2.5 to 3 mm. from the limbus to the ora serrata should be covered. Therefore, on the inner side, the punctures must extend back somewhat farther than the insertion of the internal rectus, on the inferior side just about beyond the insertion of the inferior rectus, and the same distance on the external side. If the punctures are applied to the upper part of the globe they should not extend quite as far as the insertion of the superior rectus. The coagulation needle should be left in the sclera a little longer than one second. I count 1, 2, 3 during the procedure. On the count of 1, I introduce the needle, on 3 I remove it. The needle should be under current throughout the procedure. Usually somewhat more than one third of the inferior circumference is treated. We tried to establish a relation between the number of millimeters of mercury of tension and the

number of punctures. We are tentatively following the formula: number of millimeters of mercury of tension plus 30 equals the number of punctures required. However, never more than 80 punctures should be applied in chronic simple glaucoma."

Cyclodiathermy puncture, in 16 cases of chronic simple glaucoma, has proved to be a harmless procedure, as deleterious complications have not developed in any case. Its influence on the tension and the general course of the disease has been generally beneficial. The lowering of the tension has been of long duration.

Cyclodiathermy puncture has certain definite advantages over other operations used for glaucoma simplex. It seems to work regardless of the type of

glaucoma. No late infection is to be feared. No tendency toward stimulating the development of opacities of the lens can be demonstrated. No rapid deterioration after the operation in advanced cases, as frequently seen in some of the other procedures, occurs. It therefore may be applied safely in all stages of chronic simple glaucoma.

As shown in this study, cyclodiathermy puncture is effective also for the Negro and may well become the method of choice for the treatment of the severe disease in this race. A careful observation of the technique as outlined is essential.

A discussion of this paper appears in *Arch. of Ophth.*, 1945, v. 34, p. 346.

R. W. Danielson.

PAN-AMERICAN NOTES

Edited by DR. M. URIBE TRONCOSO
500 West End Avenue, New York

Communications should reach the editor by the twelfth of the month.

MISCELLANEOUS

Chile: New ophthalmological journal. We have received the first four issues of the "Archivos Chilenos de Oftalmologia," a bi-monthly journal published under the editorship of well-known ophthalmologists in Chile. The director is Dr. S. Barrenechea, who has as honorary editors Prof. C. Charlin, director of the University Eye Clinic, and Profs. Martini, Espildora Luque, and Thierry.

Each number contains, besides original articles, the proceedings of the Chile Ophthalmological Society, abstracts, book reviews, and other material.

We wish a long life and complete success to the new journal.

Mexico: The Association for Prevention of Blindness in Mexico has issued a volume of the proceedings of the annual convention held by the association this year. It is a large and well-printed book with many illustrations. There is an introductory statistical review of the ophthalmologic work done in the hospital of the association during the year 1944. The staff includes 12 ophthalmologists, many internes, and nurses. There is also a large out-patient department. The number of operations performed in the hospital during 1944 was 670, a few more than those of the previous year. Next to cataract operations the largest number of operations was for pterygium. This fact illustrates the frequency of this disease in the semi-tropical altitude of Mexico.

In addition to this report the book includes 17 interesting papers. To be mentioned are one dealing with conjunctival involvement of onchocercosis, one with intraocular cysticercus, and others with traumatism of the skull, contact lenses, and angioscotometry. Three papers were contributed by American ophthalmologists, one by Dr. Conrad Berens and C. E. Kerby, another by Dr. Daniel B. Kirby, and the third by Dr. George Guibor. The volume ends with necrological articles and the pictures of Dr. Rafael Silva and Dr. Sanford R. Gifford, of Chicago, outlining the careers and merits of these distinguished ophthalmologists. The book is a worthy addition to ophthalmologic literature in Mexico.

The last numbers (March and August, 1945) of the "Boletín del Hospital Oftalmológico de N.S. de la Luz," of Mexico, contains interesting articles on onchocercosis, clinical applica-

tions of angioscotometry, a new method of suture for cataract operations, and a short article on ocular leprosy.

The National Society for the Prevention of Blindness participated in the Pan-American Congress of Ophthalmology. Mrs. Eleanor Brown Merrill, the executive director, accepted an invitation to participate in this Congress and attended the meetings in the last week of November, 1945. She presented a paper on the subject: "How medical and lay coöperation may be used in national prevention of blindness programs."

In conjunction with the Congress, a special exhibit had been prepared in Spanish, presenting in five large oil paintings the following aspects of the prevention of blindness: (1) How drops at birth save babies' eyes; (2) Pre-school eye care; (3) Need to help establish sight-saving classes; (4) Eye health and safety in industry; and (5) Periodic check-up of the eyes past mid-life. In addition, a smaller exhibit has been prepared on the use of traveling eye clinics for rural patients. These units have been presented to the Pan-American Congress with the thought that, following the meetings, they will be circulated throughout South and Central American countries at the national medical, social work, and educational meetings.

OBITUARIES

Prof. Carlos Charlin. The distinguished professor of ophthalmology of the University of Chile, Dr. Carlos Charlin, died suddenly on August 31, 1945. The funeral was held in the hall of the medical school, where representatives from the Institution, from San Salvador Hospital, from the Chile Ophthalmological Society, and from other associations read addresses outlining the scientific and professional career of Dr. Charlin. The "Archivos Chilenos de Oftalmologia" published a special number in his honor containing a list of his papers and of the nine books on ophthalmology he issued during his long and fruitful life. Professor Charlin was considered the outstanding ophthalmologist of Chile for many years.

Dr. Joaquin Tejeda, a member of the staff of the Hospital of N.S. de la Luz passed away in Mexico, in June, 1945. He was the ophthalmologist in charge of the eye department in the Hospital and Institute for Leprosy near Mexico City. His premature death was a matter of great regret to his colleagues.

NEWS ITEMS

Edited by DR. DONALD J. LYLE
904 Carew Tower, Cincinnati 2

News items should reach the editor by the twelfth of the month.

DEATHS

Dr. William S. Ankenbrock, Indianapolis, Indiana, died September 28, 1945, aged 49 years.

Dr. Fletcher L. Crocker, Pontiac, Illinois, died August 31, 1945, aged 79 years.

Dr. Edward A. Dignam, Rockville, Connecticut, died August 26, 1945, aged 48 years.

Dr. Albert D. Frost, Columbus, Ohio, died November, 15, 1945, aged 56 years.

Dr. William J. Harkins, Quincy, Massachusetts, died August 25, 1945, aged 59 years.

Dr. Nelson K. Hopkins, Arlington, South Dakota, died July 25, 1945, aged 63 years.

Dr. James W. Jervy, Greenville, South Carolina, died November 1, 1945, aged 71 years.

Dr. William L. Kenney, Saint Joseph, Missouri, died August 11, 1945, aged 72 years.

Dr. Samuel A. Miller, Longview, Texas, died August 28, 1945, aged 78 years.

Dr. Samuel W. S. Toms, Nyack, New York, died August 22, 1945, aged 83 years.

Dr. George G. Van Mater, Peru, Indiana, died August 28, 1945, aged 82 years.

Dr. James W. Wallace, Aledo, Illinois, died August 26, 1945, aged 64 years.

Dr. Benjamin B. Wechsler, Pittsburgh, Pennsylvania, died August 17, 1945, aged 66 years.

Dr. Joseph B. Workman, Ware Shoals, South Carolina, died September 20, 1945, aged 67 years.

MISCELLANEOUS

The Department of Ophthalmology, Northwestern University Medical School, has received an additional gift of \$4,000 to the Sanford R. Gifford Memorial Fund from Mr. Bernard Spero, president of the House of Vision, Chicago. It is proposed to use this sum to establish a fellowship in research and teaching of refraction and allied subjects to young ophthalmologists.

A change in the examination dates of the American Board of Ophthalmology has been announced. The examination originally scheduled to be held in Los Angeles, January 28th-31st has been changed to San Francisco, June 22d-25th. Other examinations will be: New York, about April 14-19th, and Chicago, October 9th-12th. A new ruling requires that previously accepted candidates mail their lists of surgery to the Board office at least 60 days prior to their examination. All new applicants are now required to send their lists with their application.

Dr. S. Judd Beach, Portland, Maine, is secretary-treasurer of the Board.

Washington University School of Medicine in Saint Louis announces a four-week intensive refresher course in ophthalmology from June 3 through June 29, 1946. The 131 hours of didactic lectures will cover the important phases of ophthalmology. The course is designed primarily for the returning veteran, but should also serve as an excellent review for candidates for the examination by the American Board of Ophthalmology. Tuition fee: \$200.00. An outline of the course as well as more detailed information will be sent on request. All applications or inquiries should be addressed to Dr. Richard G. Scobee, Director of Graduate Training in Ophthalmology, Washington University School of Medicine, 640 South Kingshighway, Saint Louis 10, Missouri.

Emory University will hold an ophthalmological seminary honoring the memory of Dr. Abner Wellborn Calhoun, April 4th to 6th. Guest lecturers will be Drs. William Benedict, John Dunnington, Parker Heath, Walter Lillie, Derrick Vail, and Frank Walsh. All members of the ophthalmological profession are cordially invited as guests of Emory University. Make reservations early at the Atlanta Biltmore.

The Oregon Academy of Ophthalmology and Otolaryngology will hold its sixth annual spring postgraduate course in ophthalmology and otolaryngology in Portland, April 15 to 20, 1946. Among the guest speakers will be Dr. Algernon B. Reese, professor of ophthalmology at Columbia University, and Dr. Gabriel Tucker, professor of bronchoscopy and laryngology at University of Pennsylvania Graduate School, Philadelphia.

The third ophthalmologist's office-assistant's course in fundamental optics was held at the Pember-Nuzum Clinic, Janesville, Wisconsin, from February 2d to 16th. Among the participants in giving the course were Dr. Aubrey H. Pember, Selma Weiskopf, Austin B. Belgard, and Ralph Lowrey.

The Gill Memorial Eye, Ear, and Throat Hospital will hold its nineteenth annual spring graduate course in ophthalmology, otology, rhinology, laryngology, facio-maxillary surgery, and bronchoscopy and esophagoscopy, from April

1st to 6th. The courses in ophthalmology will be conducted by Drs. Charles A. Perera, F. Philip Koch, Edmund B. Spaeth, George P. Guibor, Merrill J. King, William F. Hughes, Jr., Frank Payne, and Isaac S. Tassman.

SOCIETIES

The guest speaker of the October dinner meeting of the Cleveland Ophthalmological Club was Dr. John E. L. Keyes, who spoke on "The present status of penicillin in ophthalmology."

Dr. Martin Cohen, professor of ophthalmology in the Graduate School of Columbia University, was the speaker at the December dinner meeting of the Cleveland Ophthalmological Club. Dr. Cohen spoke on "Fundus changes observed in nephritis, diabetes, and hypertension." His talk was illustrated with many beautiful lantern slides. Because of his valuable contribution to ophthalmology, Dr. Cohen was made an honorary member of the Cleveland Ophthalmological Club.

The following officers were elected by the Section on Ophthalmology, College of Physi-

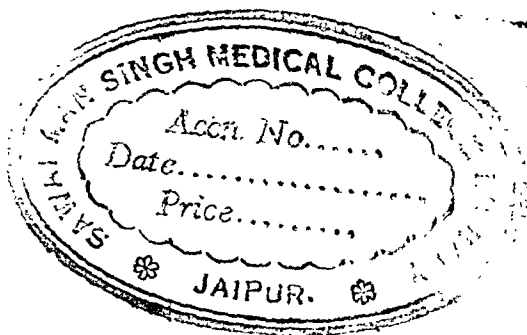
cians of Philadelphia: Dr. Burton Chance, chairman; and Dr. George F. J. Kelly, clerk. Meetings are held the third Thursday of every month from October to April.

The Research Study Club of Los Angeles conducted its fifteenth annual midwinter post-graduate clinical assembly in ophthalmology and otolaryngology from January 21st to February 1st. Guest speakers included Dr. Meyer Wiener, Dr. Frederick C. Cordes, Dr. Herbert M. Evans, and Irving B. Lueck, B.S.

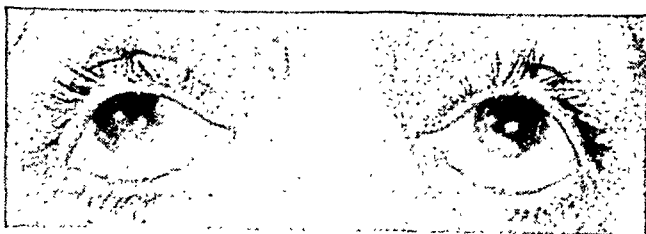
At the January 22d meeting of the Milwaukee Oto-Ophthalmic Society Dr. Avery D. Prangen presented a paper on "Some clinical aspects of refraction."

PERSONALS

Dr. Joseph I. Pascal has just returned from South America where he attended the Pan-American Congress of Ophthalmology held in Montevideo, Uruguay, the week of November 26 to December 2, 1945. Dr. Pascal was a delegate from the New York Society for Clinical Ophthalmology and at the scientific session of the Congress read a paper on "An accommodative unit in corrected ametropia."



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MANUEL URIBE TRONCOSO, M.D.

New York

HISTORY

Shahan and Post¹ in 1921 were the first to apply heat to the limbus by means of the thermophore in order to obtain a reduction of the intraocular pressure. They used rabbits' eyes and 40 human eyes affected with glaucoma. Curran² (1925) devised an operation which consisted in cauterizing the sclera with the galvano-cautery near the limbus, over an area 8 to 10 mm. in diameter. His purpose was, first, to interfere with the function of the ciliary body at the place of cauterization and, second, to produce a decompression staphyloma. He succeeded in lowering the intraocular pressure, but the effect was temporary. Fiore³ in 1929 reported at the International Congress of Ophthalmology in Amsterdam the results of an operation with the galvano-cautery in which the sclera and ciliary body were perforated several times. He made linear applications in a meridional direction from the limbus to the ora serrata. His idea was, first, to make a destructive coloboma of the ciliary body and reduce edema; and, second, to cut the ciliary muscle ring and allow a freer flow of the

intraocular fluids. According to the author, the operation was performed with success on 177 eyes, the majority of which were affected with acute glaucoma.

Vogt⁴ in 1937 for the first time applied diathermy to the ciliary body with the object of obtaining a reduction of the intraocular pressure in glaucoma. He called this method "cyclodiathermy." The operation consisted of a great number of transcleral punctures (usually 100 or more) made with a special small needle, 0.5 mm. long and 0.18 mm. thick, provided with a stop and using about 60 milliamperes (fig. 1). The needle was pushed vertically into the sclera at intervals of

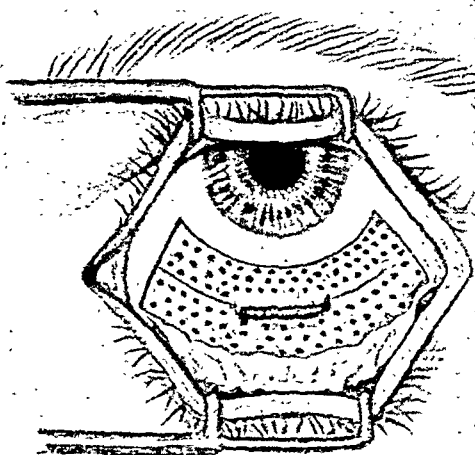


Fig. 1. Vogt's operation for cyclodiathermy. The severed tendon of the inferior rectus muscle is in the center of the coagulated area.

* From the Department of Ophthalmology, Columbia University, and the Eye Institute of the Presbyterian Hospital. By a grant from the Harriman Glaucoma Fund.

0.5 to 0.25 mm. and left there for one-half to 1 second. The punctures included an area $2\frac{1}{2}$ mm. distant from the corneal limbus and as far back as the insertion

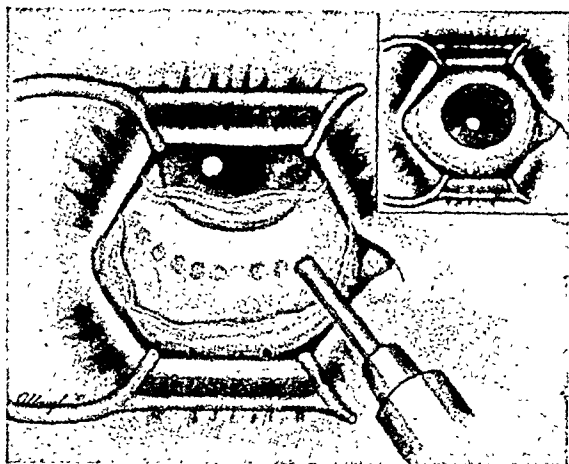


Fig. 2. Albaugh and Dunphy's method of nonperforating diathermy.

of the tendon of the inferior rectus, in front of the ora serrata. Laterally, they reached the insertions of the internal and external recti. The coagulated area thus included from one third to one half of the circumference of the globe.

Vogt stressed the fact that the punctures were made wholly in the orbiculus or pars plana of the ciliary body and that the ciliary processes were not touched. He stated that no theoretical explanation can be given for the action of his operation, but that the damage to the ciliary body (orbiculus in his case) may bring about a reduction of the secretion of the aqueous.

He used his method only in severe cases when all other methods had failed and in hemorrhagic glaucoma. The punctures produced an oozing of the vitreous body and the intraocular pressure was immediately lowered. He reported a case of necrosis of the sclera.

In 1939 Wagner and Richner,⁵ following Vogt's methods, reported 47 operations of this kind for various types of

glaucoma. They claimed that 72 percent were successful. Two cases were studied from the standpoint of pathologic findings.

At the meeting of the American Ophthalmological Society in 1943, Albaugh and Dunphy presented a paper on cyclo-diathermy⁶ in which they described two kinds of operation: first, perforating punctures applied according to the technique of Vogt but limited to only one quadrant of the circumference of the globe. They stated that the original Vogt method gave rise to great inflammatory reaction and had subsequent complications. By their second method a nonperforating diathermy, performed with a flat electrode of the Weve type, was applied 4 to 5 mm. behind the limbus in one row over one half of the globe (fig. 2). The electrode has to be applied hard against the sclera, otherwise there is no penetration of the current and the coagulation effect is only superficial. The authors preferred the latter method of diathermy and used it in 32 cases, with success in 25 and failures in 7 patients. They especially advocated nonperforating cyclo-diathermy when other medical and surgical treatments had failed and when an opening of the globe had to be avoided because of the great danger of a sudden reduction of intraocular pressure.

At a meeting of the Chicago Ophthalmological Society in 1941, Dr. Samuel J. Meyer⁷ gave a preliminary report of diathermy of the ciliary body. In the discussion that followed this communication, Dr. L. Bothman said that in the University of Chicago Clinic the operation had been performed not only on blind, painful, glaucomatous eyes for which other treatment had failed but also on one eye with 20/20 vision and on another with 20/100, with no further loss of vision in either. Although in most instances the tension

rose again in a few weeks, the patient was relieved of unendurable pain. Dr. G. H. Mundt stated that of three patients operated on, two had an excellent result as to tension. Ordinarily, operations can be performed under local anesthesia, but with this kind of procedure it is difficult. Although patients are given morphine and nembutal and fully prepared for surgery, they shrink from the diathermy.

Somewhat more recently, Dr. Dupont Guerry, III,⁸ published an account of his experiments on the use of diathermy to block the long ciliary arteries and obstruct circulation of the ciliary body. He claimed to have obtained good results in producing permanent reduction of intraocular pressure in glaucomatous eyes.

ANATOMIC RELATIONS AND DISTANCES OF THE STRUCTURES OF THE ANGLE IN RABBIT AND MAN

The effect of diathermy varies not only according to the intensity of the current and the depth and length of application but also according to the anatomic place that is coagulated or destroyed. This last factor is of great importance, so that special consideration of the anatomic relationships of the structures in the angle of the anterior chamber is necessary before an operation is undertaken.

The relative distances from the orbiculus and processes to the iris root and angle of the anterior chamber in normal animal and human eyes were measured, freshly enucleated eyes being used which had been kept in formalin for one day. If a puncture is made with a Graefe knife into the sclera of a rabbit's eye, 2 mm. from the limbus on the nasal side, where the processes are longer, the tip of the knife will appear in the ora serrata exactly behind the ciliary body, not having touched the processes at all. When the puncture starts 1 mm. from the limbus, the knife divides

the ciliary processes in half. When puncture is made exactly at the limbus and perpendicular to the scleral wall, the perforation cuts the head of the processes.

In the human eye a cataract knife puncturing the sclera 5 mm. from the limbus runs through the orbiculus but does not touch the processes. When the puncture starts 3 mm. from the limbus and perpendicular to the sclera, the blade perforates the ciliary body exactly behind the processes; when started 2 mm. from the limbus the knife reaches the anterior part of the processes at their base, just behind the iris; when introduced 1 or $1\frac{1}{2}$ mm. behind the limbus, the perforation reaches the angle of the anterior chamber in front of the iris.

Using microscopic slides of normal human eyes one finds the distances of the structures at the upper part of the globe to be as follows: From the limbal edge of the conjunctiva to the bottom of the recess of the anterior chamber, 1 mm.; from the recess of the chamber to the posterior end of the processes, $1\frac{1}{2}$ to 2 mm.; from the recess of the chamber to the ora serrata, from 4 to 5 mm. Sometimes this 5-mm. distance encroaches on the choroid. In view of these relationships it is evident that at 5 mm. and even at 3 mm. from the limbus, the distance at which cyclodiathermy is usually performed in man, only the orbicular region is seared. The processes are not touched, although there is, of course, some indirect effect on the organs, depending upon the intensity of the current and the extent of the coagulated area. It is necessary to make the diathermic puncture from $1\frac{1}{2}$ to 2 mm. behind the limbus in order to reach the head and body of the ciliary processes. It should be remembered that in man the processes are comparatively short and the orbiculus covers a large area. Lagrange, who has made the same

measurements in human eyes, reported the following values: In the upper part of the globe from the edge of the limbus to the sinus of the chamber—1.75 mm.; at the lower part of the globe for the same distance—1.45 mm.; at the nasal side—1 mm.; at the temporal side—1 mm.

PHYSIO-PATHOLOGIC EFFECTS OF DESTRUCTION OF THE CILIARY BODY

It is acknowledged that from a physiologic standpoint the orbiculus has probably no secretory function as regards the production of aqueous. The highly vascularized processes, on the contrary, are the source of this secretion and must be destroyed to a greater or less extent if a diminution of the fluid output and a lowering of the intraocular pressure are contemplated.

Wagenmann⁹ (1890), experimenting on rabbits, found that section of the long posterior ciliary arteries produced a reduction in intraocular pressure by changing the vascular supply of the eye. Verhoeff¹⁰ (1924) removed with a knife a part of the ciliary body to induce a lowering of the intraocular pressure, a method he called "cyclectomy." In support of his idea he mentioned the fact that injuries and inflammations of the ciliary body have a marked tendency to lower the pressure. He also considered that "cyclectomy" might alter the vascular condition in such a way as to reduce the intracapillary blood pressure.

H. Coppez¹¹ (1927 and 1929) reported his experimental work on diathermy in rabbits and concluded that the effect of this procedure is to destroy the ciliary body and thus diminish the amount of aqueous secreted into the anterior chamber. He stated that the results of the operation can be measured more or less by the amount of destruction to the ciliary body. When it is very limited, the tension

returns to normal very soon; but if extensive, the destruction may produce not only a reduction of tension but at length an atrophy of the eyeball. He emphasized the importance of further studies in this direction.

The Weekers¹² made experiments in rabbits and think that the principal action of diathermy is an enormous vasodilation of the uveal vessels at the beginning of the ophthalmotonic reaction. This vasodilation is not limited to the point of application of the diathermy but extends over the whole iris and choroid. When the action of the diathermy is intense, hemorrhages, superficially and within the tissues, and exudations are common. When the limits of safety are passed, complications arise such as hyphema, iritis, cataract, choroiditis, and detachment of the retina. The healing process is slow and iris atrophy may be produced in the sector of the operation. When diathermy is extended to the whole circumference of the limbus, the atrophy of the iris may be so marked that the structure "disappears." Cataract and then atrophy of the globe end the inflammatory process. They believed that the vasodilation of the uvea is the cause of the hypotensive effect, but found this not to be permanent.

Meyer and Sternberg^{12a} believe that the physiologic effect of Vogt's operation is only a "scleral shrinkage" with a consequent decrease in the total volume capacity of the eyeball. This lowers the intraocular pressure, but not always, to within normal limits and gives relief with freedom from pain. When an extensive diathermy is applied, including the complete circumference of the eye over the orbiculus ciliaris, hypertension may occur during the immediate postoperative period. If the tension rises above the systolic blood pressure in the central artery of the retina, the artery becomes occluded. This occurred in one of their cases.

PROCEDURES

EXPERIMENTAL DIATHERMY

The purpose of my experiments was: (1) to repeat the diathermy operations of previous authors and determine their effects on the membranes of the eye and the intraocular pressure; (2) to coagulate directly the ciliary-body base and processes and ascertain what amount of destruction to these organs was necessary to produce a long or even permanent lowering of the intraocular pressure; and (3)

diathermy. A much easier and speedy method of observing the lesions produced was the microanatomic method with the slitlamp microscope which I have described elsewhere.¹³ The eye was sectioned in front of the equator and its anterior half placed in a glass jar filled with a special solution. The specimen was pressed against the glass for observation, the cornea away from the glass. The segment was moved up and down and tilted back to illuminate the lesions and scleral scars. In this way a perfect stereoscopic view of the

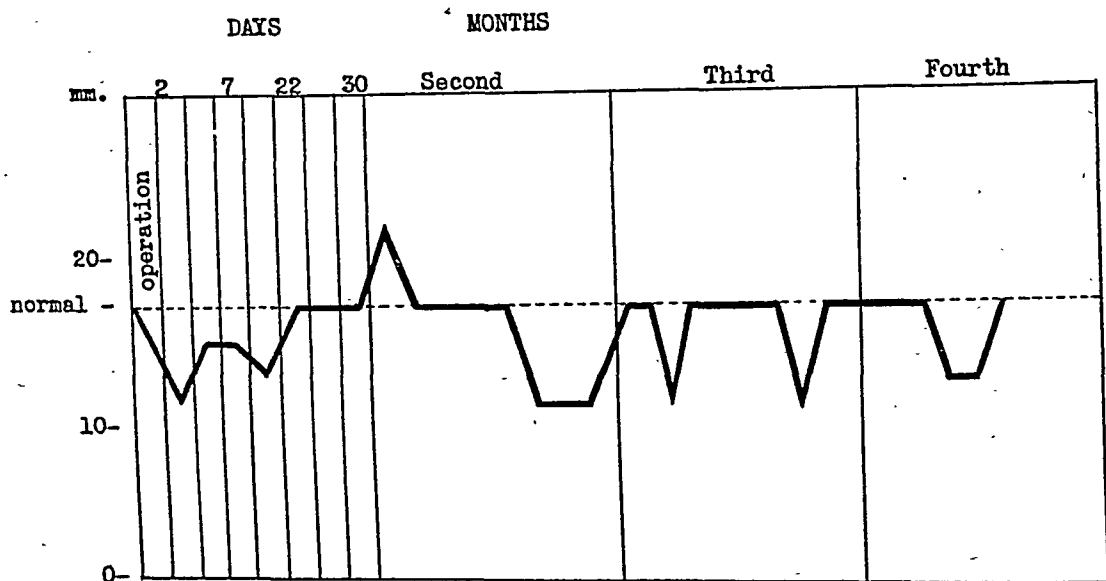


Fig. 3 (Troncoso). Tonometric curve in rabbit 7. O.D.

what effects the diathermic coagulation had upon the membranes and functions of the eye.

Ordinary diathermy machines were used, the large Lepel model and, in some animals, the Walker apparatus. At different periods of time after the operations the animal eyes were enucleated and hardened in formalin for two days. Then they were sectioned and submitted to the usual microscopic methods with serial sections made at the site of the operations. I soon found that this procedure was long and did not give a good perspective of the changes produced by the application of

coagulation changes in the processes, orbiculus, and lens was obtained under varying magnifications ($\times 15$ and $\times 30$). After this examination the most important specimens were submitted to serial sectioning and microscopic examination.

I. VOGT'S TRANSCLERAL METHOD

Not being able to obtain Vogt's special needle, I operated with a thin electrode, and the perforations of the sclera were arranged in two parallel rows (instead of Vogt's 100) about 5 mm. distant from the edge of the cornea. In the rabbit the ciliary processes are longer than in man and the

orbiculus ciliaris is reduced to a narrow band so that Vogt's directions could not be followed implicitly. One row of perforations was made in the orbiculus but

Rabbit 7, O.D. Pernostan anesthesia, retrobulbar injection of novocaine. The conjunctiva was divided 2 mm. from the limbus and a flap formed with two parallel meridional incisions. The episcleral tissue was removed and the

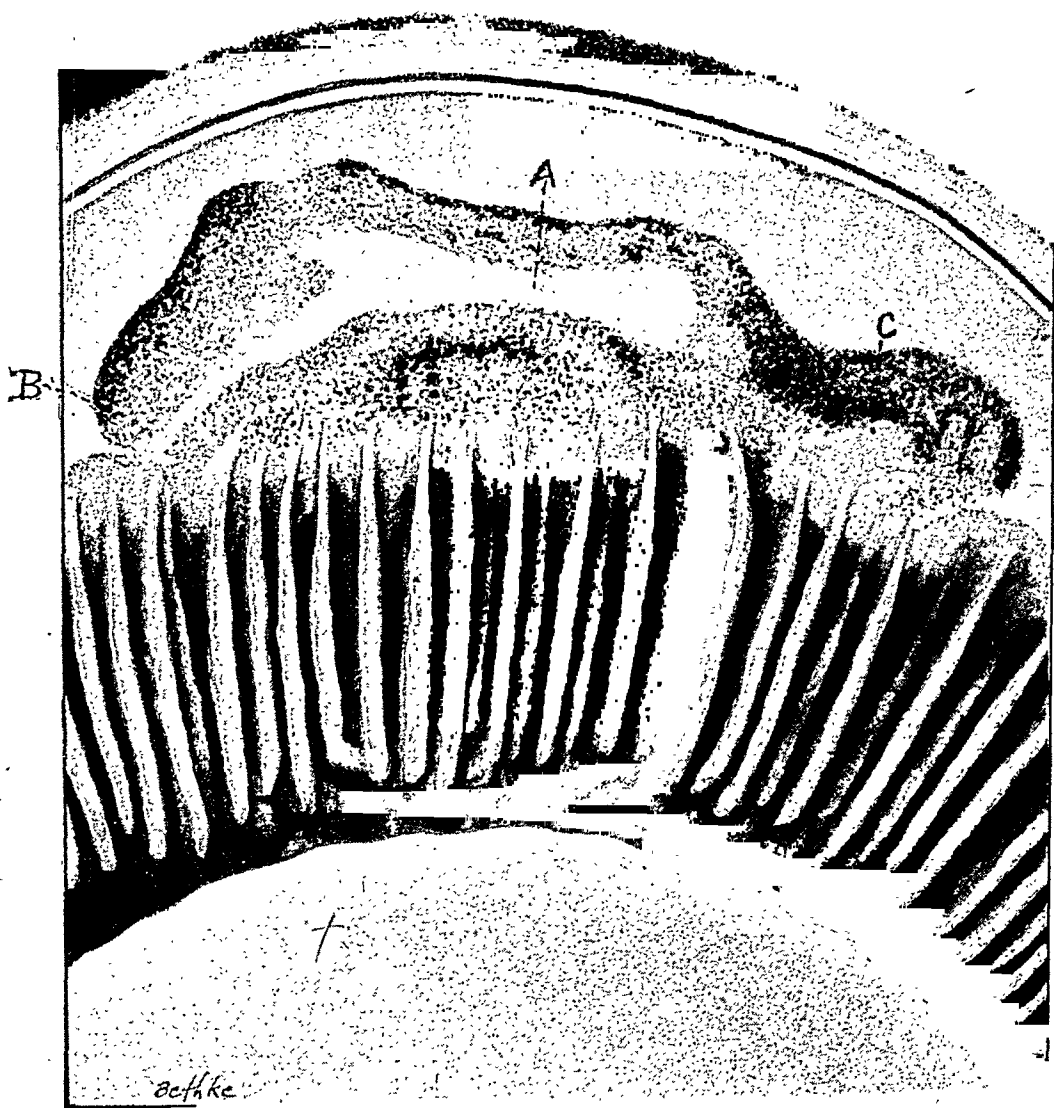


Fig. 4 (Troncoso). Experimental cyclodiathermy in rabbit 7, O.D.
Orbiculus ciliaris destroyed; scar tissue formed.

the second went farther back into the choroid.*

*The rabbit was used as the animal easier to handle, on which tonometric measures can be accurately made daily without the use of a general anesthetic. The presence of the membranous extensions of the processes has no bearing on the results of diathermy.

sclera exposed. The indifferent electrode was wrapped in moist gauze and placed under the animal's belly. The perforations were made in two rows including about one quarter of the circumference of the eyeball. The flap was replaced and sutured. The next day the eye was inflamed and the conjunctiva swollen. There was some discharge. The iris and pupil were normal to slitlamp observation. Intraocular pressure was low (fig. 3). The reaction continued to be

intense for four days and gradually diminished. The tension rose to normal after 18 days and then showed wide oscillations. At this time the reaction had subsided and the eye was quiet. The black holes of the perforations showed clearly through the conjunctiva. The animal was kept under observation for four months so that any further effects on the intraocular pressure might be observed.

Microanatomic examination. The enucleated eye was hardened in formalin and sectioned parallel to the equator. Examined under water with the slitlamp microscope ($\times 15$) the effects of the coagulation were clearly shown (fig. 4). The coagulation had affected the orbiculus ciliaris and part of the choroid. The punctures were fused together in a white, brilliant, branched band (A) surrounded above by a dark border of pigment grains (B) which extended beyond to the right to encircle a separated, round, coagulated scar (C). Under the white band, A, there was a semicircle of coagulated orbiculus and choroid which included the seared tips of some processes. The rest of these structures were superficially

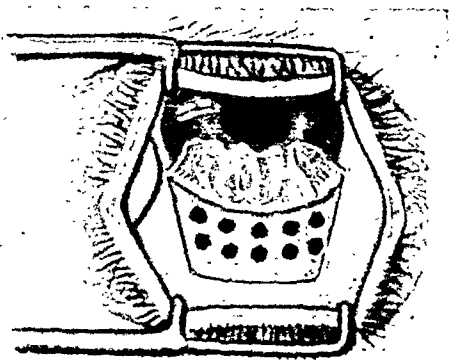


Fig. 5. Modified Vogt's method of coagulation of the orbiculus ciliaris in the rabbit.

coagulated but not destroyed. The processes under the hole (C) were also superficially seared. On each side of the changes and all around the limbus, the processes were normal. The equator of the lens appeared scalloped, but there were no

marked opacities of the rest of the lens.

Microscopic examination. There was a proliferation and dispersion of pigment in the choroid and especially in the orbiculus, together with proliferation of the

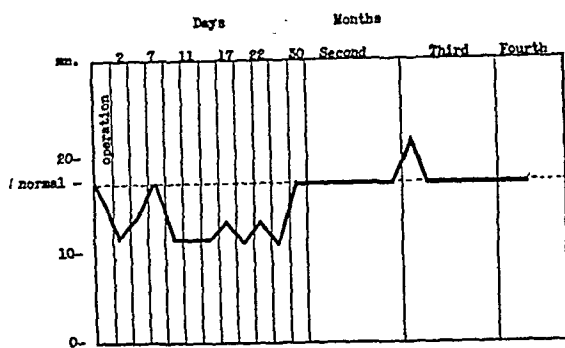


Fig. 6 (Troncoso). Tonometric curve in rabbit 8.

nonpigmented epithelium of the ciliary body. The blood vessels of the episclera were congested, and there was a leukocytic infiltration of the tissues; some of the leukocytes were laden with pigment. The sclera was somewhat thinned. The reaction extended from just behind the ora serrata to the periphery of the iris. The ciliary processes appeared normal.

In view of the slight action of diathermy on the ciliary processes by Vogt's method, other operations were made perforating the sclera immediately behind the limbus.

II. VOGT'S METHOD MODIFIED

Rabbit 8, O.S. Conjunctival flap as in the previous operation. Diathermic punctures were made in two rows of five punctures each (fig. 5). The scleral holes became black. The flap was replaced and sutured. The input current on the Lepel machine was 4 and the output $1\frac{1}{2}$ degrees. The day after the operation, the reaction of the eye was much more active than after the previous operation, with great chemosis and discharge. The cornea was turbid and there was a slight iritis with exudate over the iris and contracted pupil. The tension came down to 11 mm. and then slowly rose to normal one week later (fig. 6). It fell again and stayed low with oscillations until the 25th day after the operation. The inflammatory reaction continued very

marked; the cornea was hazy and the pupil became oval under atropine. Cicatrization started slowly, and the inflammation subsided entirely about one month after the operation.

Microanatomic examination. The effects of the coagulation were very considerable. There was a brilliant white area of coagulation at the limbus, but the principal effect was apparent in the processes, which were completely destroyed, leaving only small white stumps near the ora serrata. The lesions were similar but not so intense as in figure 12. A peculiar fact was the preservation of the zonular fibers, which could be seen all over the coagulated area as fine, white, parallel threads extending from the ora serrata to the lens. The latter was swollen and seared at the spot in front of the lesions. The choroid showed a great dispersion of pigment.

Microscopic examination. The reaction extended from the periphery of the iris to the ora serrata. The iris was adherent to the posterior surface of the cornea, at this place blocking the angle. There was a marked proliferation of the pigmented and nonpigmented layer of the ciliary body just anterior to the ora serrata. The sclera over the treated area was reduced to about one half or three fourths of its normal thickness. There was an increase in the number of superficial blood vessels. Leukocytic infiltration and some hemorrhages were observed in the tissue. The ciliary processes were swollen and the apices destroyed.

III. NONPERFORATING DIATHERMY

For comparison with the effect of Vogt's operation the nonperforating diathermy of Albaugh and Dunphy was used in several eyes.

Rabbit 13, O.D. A conjunctival flap was cut 7 mm. from the limbus, dissected, and rolled forward with the purpose of having a good protection for the seared spots. Diathermic coagulation was made with a spherical electrode, 1 mm.

in diameter, in one row and about 5 mm. from the limbus (see figure 2). The electrode was pressed hard against the sclera until the membrane became blue-black but without perforating it. Six large spots were made. The input of the current was 3 divisions; the output $3\frac{3}{4}$. The next day the eye showed considerable reaction. The conjunctival flap was swollen, although the cornea was clear and the lens normal. The tension went down to 4 mm. and stayed low for 49 days (fig. 7). It then rose to normal but had another long downward oscillation. Ten days after the operation the

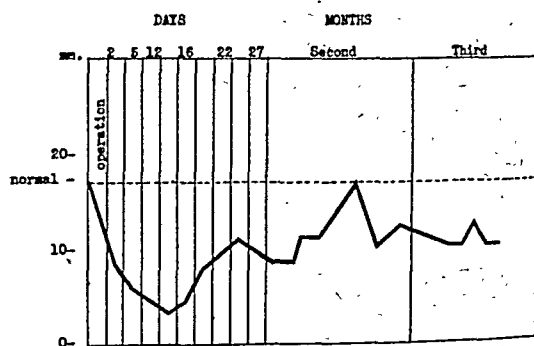


Fig. 7 (Troncoso). Tonometric curve in rabbit 13.

inflammatory reaction was still marked; the pupil was dilated, and the iris had numerous new vessels, observable under the slitlamp microscope. Below the lens capsule there were vertical, opaque streaks. Seventeen days later the eye became quiet; the cornea was clear but the limbus showed great vascularization. The animal was killed $2\frac{1}{2}$ months after the operation.

Microanatomic examination. By transillumination the coagulated spots in the sclera appeared as thin, bluish, semi-transparent circles. This rabbit was an albino, so the coagulation changes were not clearly recognized by differences in pigmentation and color. On the other hand, the greatly increased vascularization was readily observed in the normal processes whereas the coagulated ones were entirely deprived of vessels. Below the six seared scleral patches only two or three processes appeared white, semi-transparent; and bloodless. The coagulation effects were mostly confined to the orbiculus and choroid. The choroidal

veins were greatly hyperemic and formed a beautiful, circular, branching design running parallel to the ora serrata. The lens was opaque at the equator, its contour becoming wavy.

IV. NONPERFORATING DIATHERMY NEAR THE LIMBUS

Rabbit 19. To study the effects of this operation directly over the ciliary processes, the coagulation spots were placed immediately behind the limbus. Six large searing circles were made with the ball electrode with a current input of 3 and an output of $3\frac{1}{2}$. The searing effect depends not only on the intensity of the current, but upon the length of application and amount of pressure over the sclera. The reaction of the eye was very severe the next day, much greater than in previous animals. There was considerable chemosis, discharge, haziness of the cornea, and blood and exudates filled the anterior chamber. The pupil was dilated and the conjunctiva coagulated near the limbus. The inflammation continued to be intense for 15 days and then slowly subsided. The exudate in the anterior chamber became absorbed; the cornea cleared although it was covered above with new vessels. The iris became adherent to the lens upward, but was active. The lens was opaque at the site of the operation. Three weeks after the operation the eye became quiet. Hypotony was marked for 15 days and then the tension returned to normal after some oscillation. In another animal (rabbit 23) the inflammation was much more severe. At the end of two weeks the vascularized cornea began to dilate downwards and finally the ectasia invaded the whole cornea. The eye later became entirely soft and atrophic.

Microanatomic examination. The large coagulated spots on the sclera appeared as brown areas extending beyond the ora serrata. At other places the choroid and retina were fused together and coagulated. Exudates in the shape of membranes or threads extended in places from the ciliary body to the lens. The processes were entirely destroyed for about one third of the circumference of the eyeball. Their original places were filled with brown masses of tissue on which white striae ran parallel. At some spots the coagulated processes had kept their shape.

The corneal opacity was due not only to a direct searing, but also to the obliteration of the perilimbal vessels which considerably disturbed the nutrition of the corneal membrane. The lens was swollen and opaque upward. The eye later became entirely atrophic and soft.

COMMENTS. Perforating diathermy by the method of Vogt from $2\frac{1}{2}$ to 5 mm. from the limbus produced large coagulated areas in the orbiculus ciliaris and choroid but had but a slight, only indirect effect on the processes. The fact that even in the rabbit, which has such long processes and narrow orbiculus, the former were not directly affected indicates that in man, whose orbiculus is so wide and whose processes are small, the Vogt diathermy would be effective especially in the orbiculus. This method produces a severe inflammatory reaction which ends in a cicatricial atrophy of the membranes. The lowering of the tension is only transitory.

When the diathermic punctures were made in the rabbit $1\frac{1}{2}$ mm. from the limbus, the processes were completely destroyed at the site of coagulation. The inflammatory reaction was, however, much more severe. There was an involvement of the iris and lens. The lowering of the ocular tension was only temporary. It is surprising that even after this severe traumatism the eye recovered and did not show externally the great destruction of the inner structures. Probably through a compensatory mechanism, the overaction of the remaining processes raised the tension again to normal.

The nonperforating diathermy of Albaugh and Dunphy, placed 5 mm. behind the limbus, produced not only a coagulation of the orbiculus but also had an effect on the processes, which appeared avascular and seared. Probably on this account, lowering of the ocular tension

was more marked than after the use of the ordinary Vogt method. The reaction had a shorter duration.

Inflammation of the iris and changes in the lens make both of the original methods, perforating and nonperforating, applicable only to old glaucomatous eyes, as a last resort for alleviating pain and lowering the tension. The nonperforating diathermy appears to be the more effective and the less dangerous.

NEW METHODS OF SURGICAL DIATHERMY OF THE CILIARY BODY

In the operations previously described the effect of the diathermy was always spread over a large portion of the orbiculus, ciliary body, and choroid. In the operations that follow, my idea was to limit the diathermic coagulation to a few, three to six, processes and to study the effects that this diminution of the secretory power of the ciliary body may have upon the nutrition of the eye and the balance of the intraocular fluid. Two methods of approach were tried: (1) the posterior route, by incising the sclera 5 mm. from the limbus, as in a cyclodialysis operation, and coagulating the ciliary body through the incision; (2) the anterior route, by sectioning the cornea, performing an iridectomy, and then attacking the ciliary body from in front.

A. DIRECT, LOCALIZED DIATHERMY OF THE CILIARY BODY—SCLERAL ROUTE. Rabbit 6. O.D. After a conjunctival flap was made, a scleral incision 5 mm. from and parallel to the limbus was made, as for a cyclodialysis operation. When the ciliary body was exposed, a spatula was introduced, hugging the inner side of the sclera, and was pushed into the anterior chamber. It was slowly withdrawn without making any lateral movements. In its place a fine diathermy wire was introduced into the anterior chamber and the coagulation current turned on for 10 seconds until the tissue underneath the wire was seared. After the electrode was withdrawn, a small vitreous bead prolapsed but did not rupture. The conjunctival flap was replaced and

sutured. The current input on the Leibel machine was 3 and the output $3\frac{1}{2}$. Two days after the operation there was a slight reaction, with swelling of the flap and discharge. The slitlamp examination showed the cornea to be clear and a small white-red exudate covering the iris at the site of coagulation under the limbus. Seven days later the eye was only slightly inflamed, but an accidental trauma broke the conjunctival suture and allowed a small vitreous hernia to appear. The flap was again sutured into place. On the iris a radial, dark, linear depression showed, due to the coagulation. Two weeks after the operation a slight iritis was present with aqueous flares, deposits of pigment in the lens, and a small posterior synechia. Under the action of atropine the pupil dilated, except upward, and the lens proved to be clear. With the ophthalmoscope a small hemorrhage could be seen in the anterior part of the vitreous. One month after the operation the eye was normal. The hemorrhage had become absorbed and the iris showed a white atrophic spot at the site of the operation. The intraocular pressure was reduced and stayed low for 19 days then rose and remained normal with oscillations for one month.

Microanatomic examination. The scleral scar from the inside (fig. 8) appeared as a round, white, depressed tissue (A) half of which was located beyond the ora serrata and half in the ciliary body, with clear-cut pigmented margins. Pigment was also massed in the choroid (B). About five processes had been entirely destroyed in the area of the corona. They were drawn together in the middle by a mass of cicatricial tissue, made of strong, white strands. On either side of the coagulation the processes were normal. The lens was clear.

Microscopic examination. A localized area of the sclera over the ora serrata was thinned to about one half of its normal thickness. In this area there were leukocytes, red blood cells, and a dispersion of pigment. The adjacent pigmented and nonpigmented epithelium of the ciliary body had proliferated. Near this site were chorioretinal adhesions. The base of the processes was swollen but there was no peripheral synechia.

B. EXTENSIVE DIRECT DIATHERMY OF THE CILIARY BODY. Rabbit 4, O.S. Conjunctival flap as in previous operations. The scleral incision was made 2 mm. from the limbus with the object of reaching the processes more directly. The spatula

of vitreous. The current input for this operation was 3 and the output $3\frac{1}{2}$. The conjunctival flap was sutured. Two days later the eye showed little reaction. The conjunctival flap was swollen and there was some discharge. The cornea was

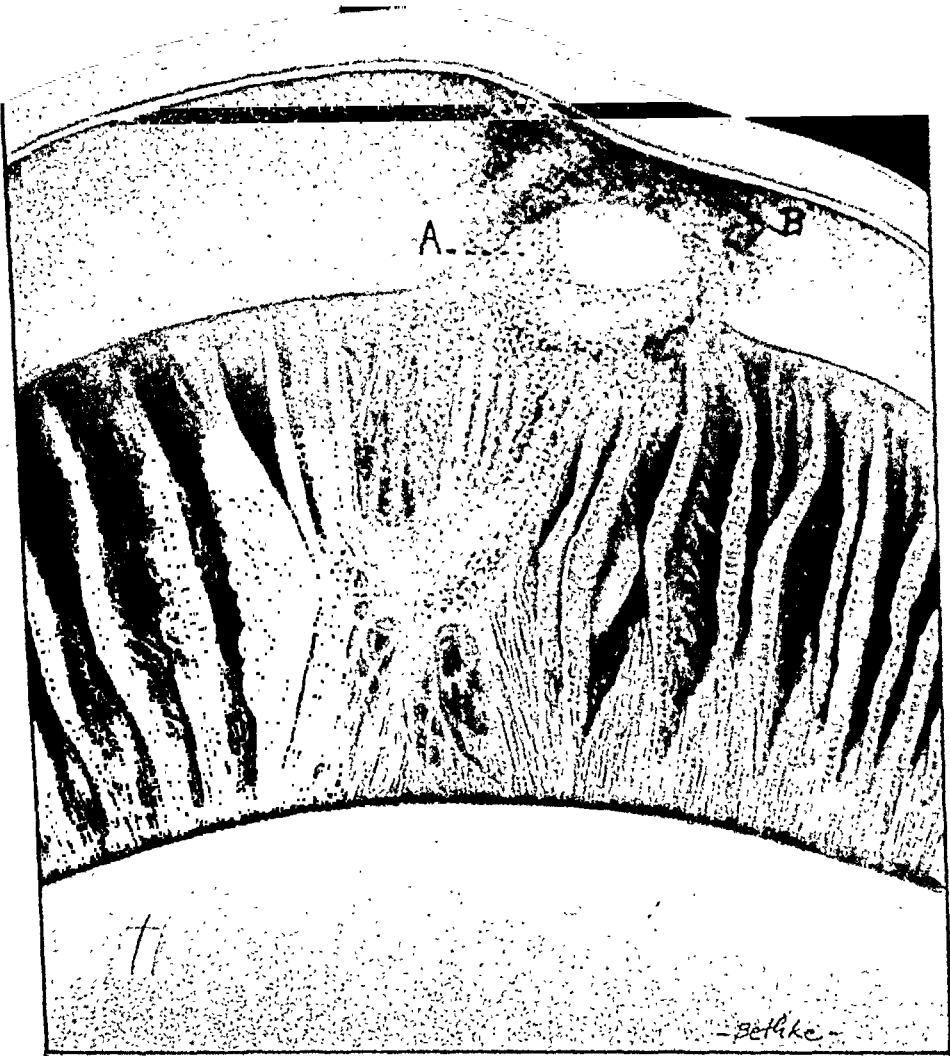


Fig. 8 (Troncoso). Experimental cyclodiathermy in rabbit 6, O.D. Ciliary process destroyed; scar tissue formed.

was moved laterally, detaching the ciliary body for about one fourth of the circumference, as in ordinary cyclodialysis. The diathermy wire was placed over the ciliary body and moved from side to side, the current being increased gradually until the iris (seen from the front) became seared and changed in color (fig. 9). There was no loss

clear and there was a slight hemorrhage over the iris below the site of operation. Five days later the reaction had subsided; the pupil was contracted. With the slitlamp the iris showed numerous new vessels and a black streak below the wound. The pupil was normal; there was no synechia. The conjunctiva was still swollen.

The intraocular pressure was very low, 9 mm., and remained so for 17 days, after which it rose to normal (17 mm.) with downward oscillations (fig. 10). Twelve days after the operation the coagulated area in the iris took on a white color; the pupil became oval. The scleral edge of the wound, which probably was coagulated, had contracted. Later the scar took a bluish color and was translucent by trans-

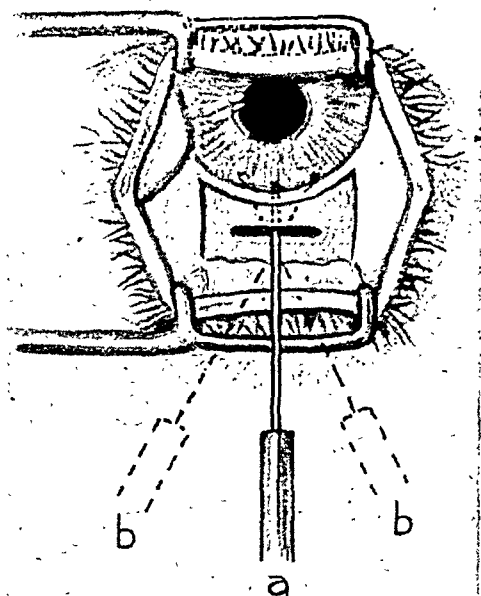


Fig. 9 (Troncoso). Direct diathermy of the ciliary body—posterior route. Incision in the sclera as for cyclodialysis. The electric wire was moved from side to side to coagulate the ciliary body extensively.

mitted light. Three weeks after the operation the eye was entirely normal.

Microanatomic examination. This being a white rabbit, the normal processes around the limbus showed great hyperemia, and there was a wreath of congested veins around the ora serrata except at the place of coagulation. The scleral scar, larger than in the previous rabbit, was elliptical, semitransparent, and depressed. Below it, a number of processes (about 6 or 8) had been entirely destroyed, only parallel lines of striae remaining visible over a white, seared background.

Microscopic examination. Over the site of the treated area the sclera was reduced to one half its normal thickness. The

fibrous tissue composing it had changed its staining reaction from green to red, owing to newly formed fibroblastic tissue. Descemet's membrane was ruptured. The overlying processes apparently had become necrotic. They had lost their epithelial elements except along the inner surface where new epithelium had grown over. A network of fibroblastic stroma and newly formed fibroblasts was growing into the necrotic stroma.

C. DIRECT BIPOLAR DIATHERMY OF THE CILIARY BODY. With the purpose of localizing the effect of coagulation between two parallel electrodes and avoiding the passage of current through the indifferent electrode, the bipolar method of coagulation was tried in several animals. Since the two wires or prongs can be moved laterally to increase or decrease the distance between them, the extent of intended coagulation in the tissues can be exactly measured. It should be stressed that the effect of this type of diathermy is considerably stronger than when the ordinary method of coagulation is used.

Rabbit 7, O.S. After the conjunctival flap had been rolled back, a scleral incision was made about 1½ mm. from and parallel to the limbus. The prongs with a 3-mm. separation were pushed directly forward upon the base

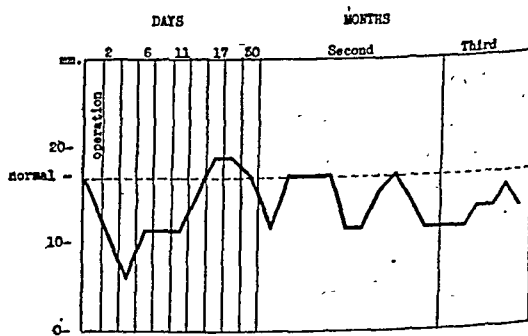


Fig. 10 (Troncoso). Tonometric curve of rabbit 4.

of the ciliary body but did not penetrate easily. A spatula was therefore introduced and the ciliary body detached from the sclera for

about 5 mm. The two wires were then introduced as far as the anterior chamber and the current passed for 20 seconds (input 2 and output $1\frac{1}{2}$). Immediately the cornea became hazy and the iris took on a black coloration at the site of coagulation. The flap was then sutured to cover the incision. Two days later, the inflammatory reaction was moderate. The conjunctiva was swollen, the cornea hazy above, and there was a dispersion of pigment in the pupillary area. No hemorrhages were visible. In six days the reaction had subsided. The tension rose considerably after the operation, then became very low, and returned to normal with large oscillations (fig. 11). Surprisingly, the eye recovered quickly after the operation so that on the tenth day it appeared almost normal. The cornea was clear and the pupil active. The animal was killed three months later. In only one of the four rabbits submitted to this method did exudates appear in the anterior chamber and hemorrhage over the iris.

Microanatomic examination. In contrast to the slight inflammatory reaction, the destruction to the ciliary body was enormous (fig. 12). Over the ora serrata were two white scars connected below by a bridge of fibrous tissue, a prolongation of which came down toward the lens. The scar was surrounded by an area of pigment dots in the choroid. The processes were entirely destroyed, shortened in the center, distorted, and coagulated on either side. At the left, strands of fibrous tissue bound the scar to the processes. The lens was swollen and coagulated above. The zonular fibers were probably coagulated but kept their normal arrangement and insertions.

COMMENTS ON THE DIATHERMY METHODS BY THE POSTERIOR ROUTE. The operations previously described establish the fact that direct diathermy of the ciliary-body base and processes is capable of destroying a number of processes without producing intense inflammatory reaction within the eye. The coagulation of a few processes can be obtained with little local effect and without greatly disturbing the nutrition of the eye. In fact it is surprising to observe how slight the general re-

action is and how quickly it subsides. The intraocular pressure in the beginning remains very low, a factor commonly noted in many other operations whereby the sclera is perforated. However, after some time (21 days in rabbit 4), it almost always returns to normal. This latter eventuality is most likely due to a com-

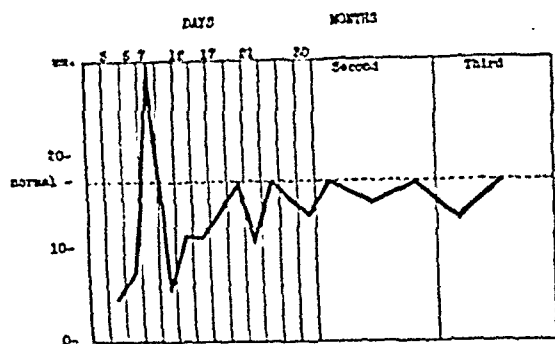


Fig. 11 (Troncoso). Tonometric curve of rabbit 7, O.S.

pensatory mechanism that brings about a hyperemia of the remaining processes and restores the secretion to a normal level. Thus the assumption that a limited destruction of the processes could produce a long, or perhaps a permanent, lowering of the intraocular pressure was not confirmed by the facts. This of course applies only to normal eyes. In congested, glaucomatous eyes, whose processes are usually involved, congested, and edematous, it is probable that the compensatory mechanism referred to will not work so effectively. In simple glaucoma where there are no congestive symptoms, conditions approach those in normal eyes.

Bipolar diathermy was undertaken with the idea of localizing the effect of coagulation to a certain area of the corona ciliaris more effectively than with the ordinary method of indifferent electrode. The experiments proved, however, that the results of the coagulation were enormous, and although the inflammatory reaction was not very marked the bipolar

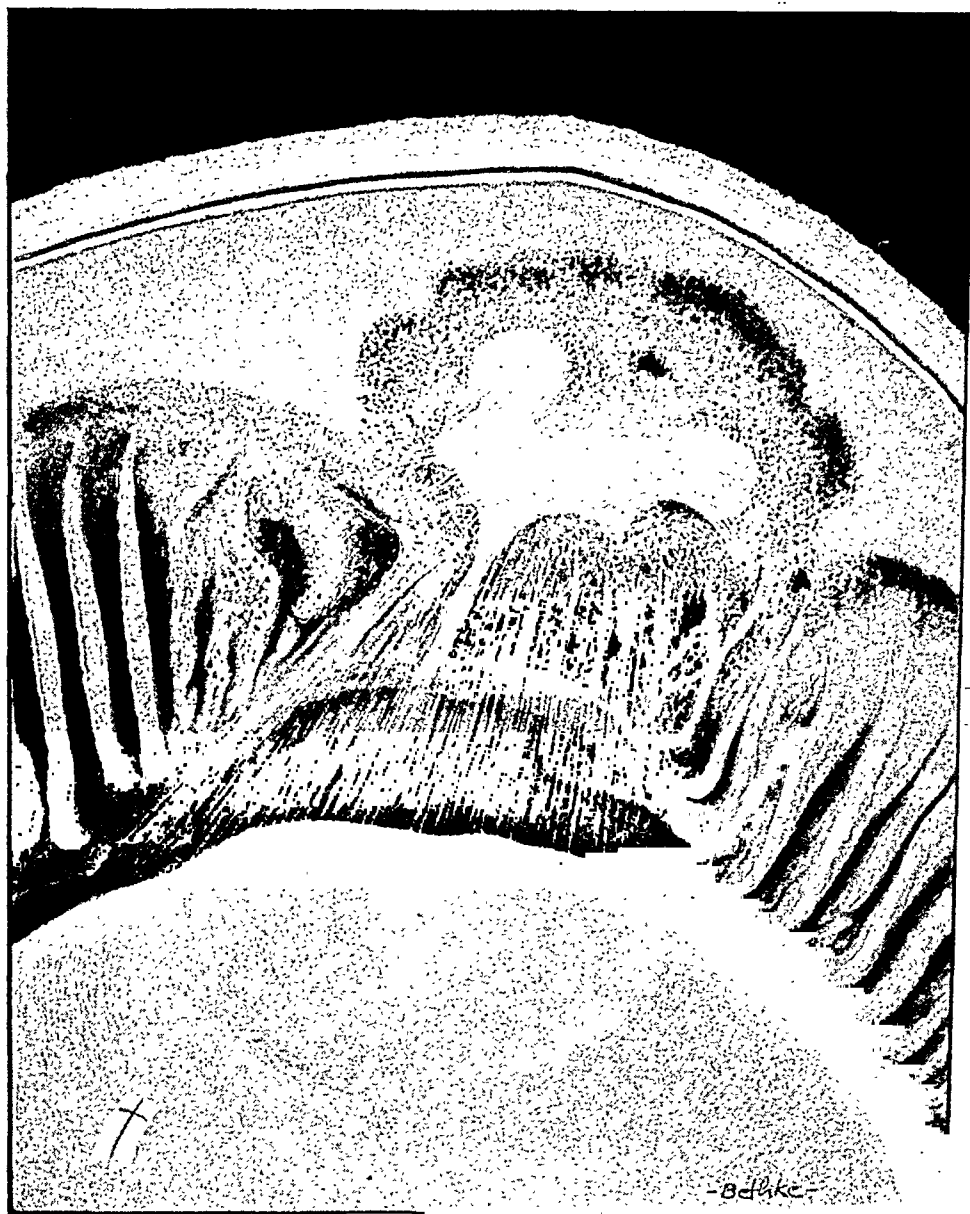


Fig. 12 (Troncoso). Experimental cyclodiathermy in rabbit 7, O.S. Bipolar method. Ciliary process destroyed; scar tissue formed.

method offered no great advantage over the ordinary form of coagulation.

D. DIATHERMIC SURGERY OF THE CILIARY BODY—ANTERIOR ROUTE. In surgery of the ciliary body, unfortunately, the electric knife cannot be used for excision of a part of the organ as in surgery of the brain. Too many important neighboring structures such as the zonula, lens, and others, would be irreparably dam-

aged. Coagulation by diathermy of a portion that stays in place would not induce so severe a trauma. With this in mind, I undertook the experimental destruction of a part of the corona ciliaris from in front through a wide iridectomy.

Rabbit 19, O.D. A corneal incision was made with a Graefe knife behind the limbus and including about one fourth the circumference of the globe. The iris was grasped with forceps, pulled out, and a broad iridectomy performed. The corneal flap was seized with a straight

forceps and rolled over until the ciliary body was well exposed. In the rabbit, iridectomy detaches the iris root and pectinate fibers from the scleral wall and leaves exposed the iridic portion of the ciliary body which includes the processes. In man, iridectomy exposes the ciliary-body front with the ciliary processes extending downward to the zonular fibers. It is easier to attack the ciliary-body base than the individual processes. A fine diathermic-wire was introduced into the ciliary-body base in a meridional direction, about 1 mm. below the inner surface of the sclera, and pushed back for 2 or 3 mm. inside the black structure (fig. 13). Diathermy is more effective if the tissues are dried before the wire is inserted. The coagulation current was then applied. It was necessary to make 5 or 6 punctures to cover the area in two

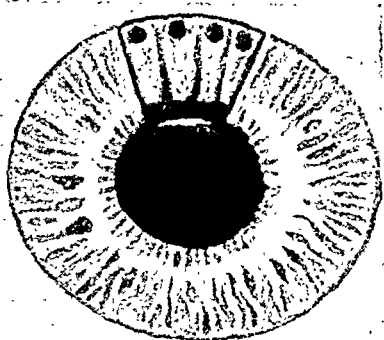


Fig. 13 (Troncoso). Direct diathermic surgery of the ciliary body—anterior route. The electric wire penetrated the base of the processes immediately below the limbus to a depth of 2 to 3 mm.

rows. The current input was 2, output 4. A slight amount of vitreous was lost. In this rabbit the structures had a tendency to prolapse through the wound; the conjunctival flap was therefore securely tied over the incision.

The course of the operation was favorable. Two days later the reaction of the eye was scant. The cornea was slightly hazy over the coloboma. Atropine, 1 percent, and sulfathiazole salve were applied. Fifteen days later the eye was quiet. Under slitlamp examination the wound was found not to have closed entirely at the center, a shred of tissue remaining between the lips. The cornea was hazy and showed many new vessels above. The coloboma was normal. Some of the pigment was deposited over the lens, which had a transparent vertical streak under the capsule. The fundus seemed normal. The slight ciliary hernia was touched twice with trichloroacetic acid, and one month later the eye appeared normal, except for a slightly

protruding corneal scar. There was some stippling of the cornea above, and two small posterior synechiae at the base of the coloboma. The lens was clear and the fundus normal to ophthalmoscopic observation. The tension went down after the operation (8 mm.), stayed low for 15 days, and then came back to normal, with up-

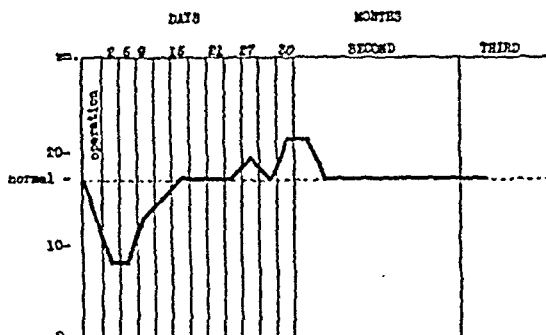


Fig. 14 (Troncoso). Tonometric curve of rabbit 19.

ward oscillations (fig. 14). The eye was enucleated two months after operation.

Microanatomic examination. At the site of the coagulation there was a brilliant, fluffy-white spot where the processes were entirely destroyed (fig. 15). Above it lay a seared brown area. A peculiar condition was the curving of the processes, which were drawn toward the scar and blended with it on either side. This adhesion probably involved first the membranous extensions of the processes, peculiar to rabbits' eyes. The ora serrata at the place of operation was irregular and wavy. The lens had a notch at the equator in front of the coagulated area but remained transparent at the center. All other structures around the coagulated area were normal.

Rabbit 20. The same technique was used except that the current was increased to input 3 and output 2 to 3, and a corneal suture was applied. The inflammatory reaction was slight, and the eye returned to normal one week later. From the corneal scar many short, new vessels ran downward. The coloboma was normal and the lens clear. There was no synechia.

The *microanatomic examination* of this eye showed a picture similar to that in the

preceding animal, but the coagulation included the whole length of the folds to the ora serrata. The processes at their bases had the same peculiar curvature and were drawn together to form an arch over the equator of the lens. The latter did not appear involved.

COMMENTS. These experiments show that it is possible to destroy a given area

treatment of glaucomatous eyes. The localized destruction of the ciliary body in these experiments was disappointing because, although it induced an immediate reduction of tension, a permanent hypotony was not obtained. Confirming Coppez's views, I may conclude that when the destruction of the processes is limited to a small number, the intraocular pres-

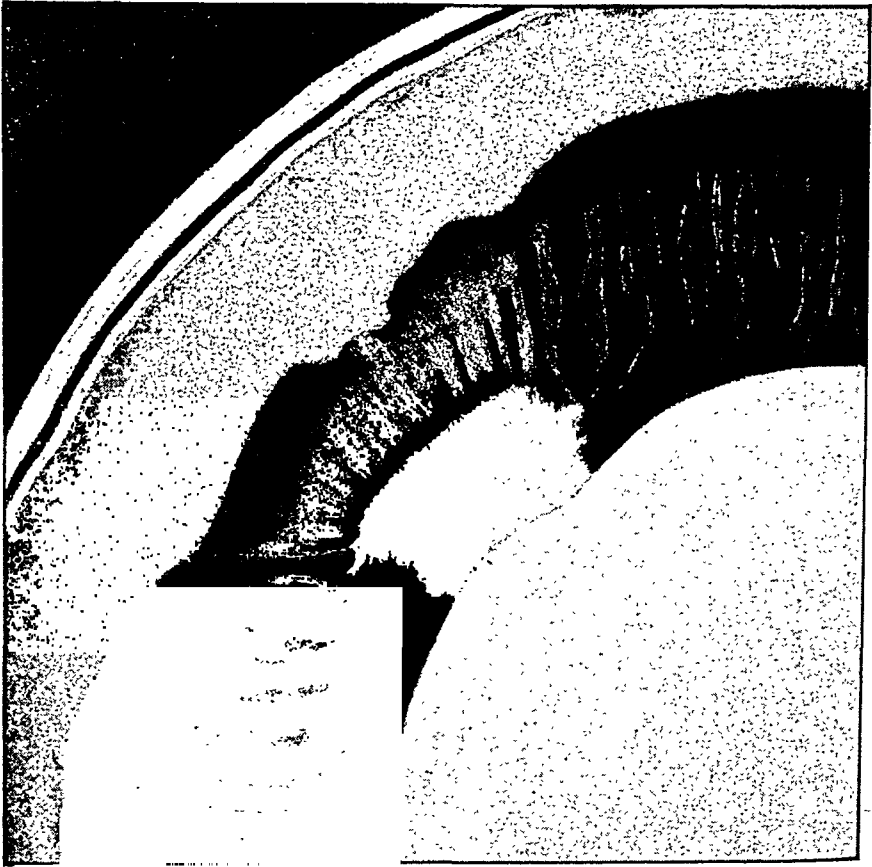


Fig. 15 (Troncoso). Surgery of the ciliary body of rabbit 19, O.D.

of the ciliary body when pathologic changes are present in the processes, with no great inflammatory reaction or danger to the eye. However the principal purpose of the experimental work reported previously was primarily to determine if a localized destruction of the ciliary processes in a small or large area could by itself produce a permanent hypotony of the eye and to apply these findings to the

sure returns to normal after a shorter or longer period of time. When the destruction is extensive, the great inflammatory reaction and considerable trauma endanger the integrity and functions of the eye and usually fail to produce a permanent hypotony.

E. TRANSLIMBAL DIATHERMY. In view of these results I attempted to combine in

a different operation the advantages of a localized destruction of the processes and the effects of a fistulizing operation through the sclera. The destruction of a few processes does not induce a considerable reaction, and when the scleral wound is healed the cicatrix is soft and probably permeable to the intraocular fluids. The fistula or at least a filtering scar in a thinned sclera can be obtained by making a diathermic puncture in an oblique direction through the limbus until the tip of the wire appears in the anterior chamber. The following experiments show the results of this new approach.

Rabbit 12, O.S. Pernostan anesthesia was used and retrobulbar novocaine injection. An incision 6 mm. long was made in the conjunctiva parallel and about $1\frac{1}{2}$ mm. distal to the limbus. On either side of it a meridional incision was cut out and the flap dissected and rolled back. (It is better to roll it back in order to obtain an unobstructed view of the limbus and anterior chamber.) A diathermy wire of medium thickness was connected to the machine

tion. The current intensity of the Lepel machine was input 2 and output 3 to 4. With the current on, the wire was pressed firmly against the sclera, 2 mm. from the limbus, and pushed gradually in an oblique direction until the tip appeared in the anterior chamber. (Slight lateral movements can be made to increase the size of the puncture.) The angle of perforation should be about 30 to 45 degrees (fig. 16). The time the needle stays in place is very important, for the longer it remains the larger the perforation. The sclera becomes blue-black at the edges of the hole; the iris changes to a darker hue, and usually a line of coagulation

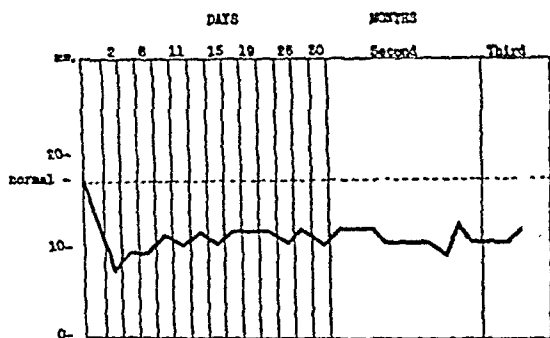


Fig. 17 (Troncoso). Tonometric curve of rabbit 12.

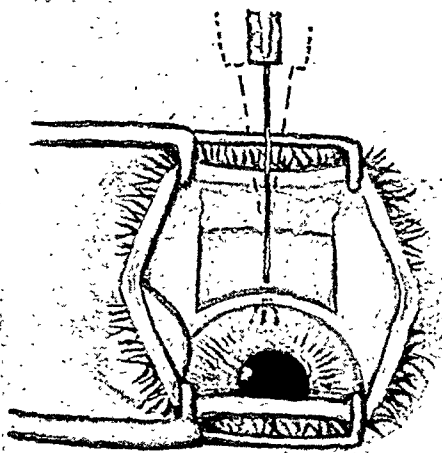


Fig. 16. (Troncoso). Translimbal diathermy to produce a limbal fistula. The electric wire penetrates directly into the scleral limbus in an oblique direction and then into the anterior chamber. It is kept there until the scleral holes become blue-black.

and the panel set for coagulation of tissues. After being wrapped in wet gauze the inert electrode was placed under the belly of the animal. The operator uses a switch pedal or, better, a holder with a finger lever for interrup-

appears over its surface. Although the wire may be rapidly withdrawn, the aqueous frequently flows out through the perforation. The conjunctival flap is then replaced and sutured to the limbus. If the aqueous is not lost, a second oblique perforation can be made, if desired, 5 or 6 mm. away from the first.

In the following days the reaction was slight. The flap was red and a little swollen. Since the rabbit was an albino, the coagulated spot in the iris appeared dark, with a thin brown-red line where its surface was seared. The cornea was clear and the pupil normal. The tension was low (7 mm.), Atropine was instilled. Ten days later the eye was almost normal. Viewed through the slitlamp the cornea showed small punctate opacities in the vicinity of the wound. The iris was covered with new radial vessels, and a slight exudate bound it to the lens at the coagulated spot. One month later the cornea still had punctate exudates; there were some new vessels along its surface. The pupil was free. The conjunctiva encroached slightly upon the cornea at the fistula and was edematous. The intraocular pressure showed a remarkably low curve (fig. 17). From 7 mm. of mercury after the operation it rose to 11 mm. and remained there with small oscillations for over two months, when the rabbit died suddenly from an intercurrent disease.

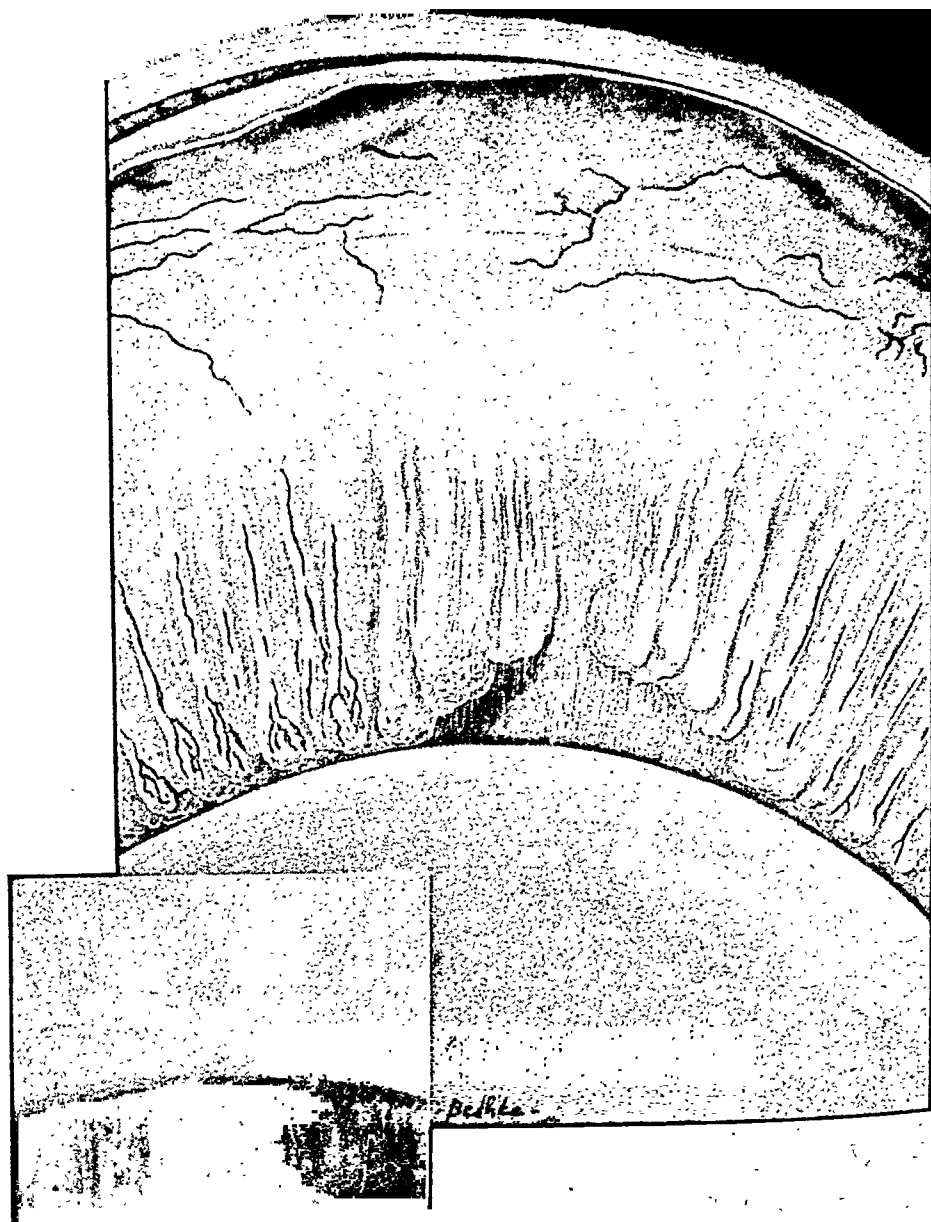


Fig. 18 (Troncoso). Experimental translimbal diathermy in a white rabbit. Ciliary process destroyed. At the bottom of the gap the perforation of the sclera appears as a thinned round area.

Microanatomic examination. At the site of the operation two processes were entirely destroyed, leaving an empty space in the corona ciliaris (fig. 18). At the bottom of this space the electric puncture appeared as a small round darker area. Three processes on either side of the gap

were coagulated, thinned, shortened, and entirely deprived of vessels. The zonular fibers could be seen running normally over and at the side of the coagulated processes. All around the limbus the remaining processes were intensely hyperemic. The choroidal vessels were also

congested and ran in branched twigs parallel to and all around the ora serrata. The lens was clear throughout. Examined from in front, the specimen showed the puncture as a round, dark depression under the conjunctiva 2 mm. from the limbus. The scar appeared to be closed by new tissue formation. By indirect illumination it looked thin and translucent.

In several rabbits operated on by the same technique, hypotony was always marked, with small oscillations, until the animal was killed.

Translimbal punctures made in man will probably coagulate also the trabeculum and Schlemm's canal if the angle is open at this point. However, it should be remembered that peripheral synechias are quite frequent after other operations; namely, on either side of a trephine opening.

MODIFICATIONS OF THE TRANSLIMBAL OPERATION

A. **SURGICAL KNIFE.** The surgical knife was tried side by side with the coagulation wire in rabbit 15. The knife penetrated more easily and rapidly through the sclera than did the coagulation wire. On the following day the iris showed a white triangle of seared tissue at the surgical penetration, whereas at the site of the coagulation the iris was seared in a larger area. The results of the operation were good and the tension remained low but went back to normal 20 days later. The animal was then killed.

The *microanatomic examination* proved that at the place of perforation with the surgical knife very slight changes had been produced in the processes, whereas at the site of coagulation five processes had been considerably seared. It is necessary to point out that when the intensity of the coagulation is low and the time of application short, the holes heal rapidly

and very little or no effect is produced in the processes (rabbits 15 and 17).

B. **THICKER WIRE.** A wire about the size of an ordinary pin with a sharp point was tried but the penetration power was small. In rabbit 20, the effects were marked. A large number of processes were destroyed (about eight) and the choroid was seared. However, even with this great traumatism the inflammatory reaction was not considerable. In another rabbit, a fibrinous exudate, pink in color, covered the lower half of the pupil. The cornea was slightly turbid and the anterior chamber shallow. Four days later the exudate was absorbed, and the eye became quiet. The lens remained clear. Hypotony was considerable for the whole period with some oscillations.

C. **TRANSLERAL PERFORATION.** A perpendicular perforation was tried on rabbit 21 simultaneously with an ordinary oblique translimbal puncture. The wire was first introduced perpendicular to the sclera, 1½ mm. from the limbus and about 2 mm. in depth. It was kept in place until the sclera turned blue-black. Then a few millimeters away a regular translimbal operation was performed. The idea was to reinforce the effect of the latter and to obtain a greater destruction of the ciliary body. After the operation the reaction was slight; the tension was very low. The cornea was clear and the lens transparent.

Twelve days later the eye was enucleated and the *anatomic examination* showed very great destruction. Around the translateral puncture the processes and choroid were coagulated in a large area and a hemorrhage was present partly over the processes and partly over the equator of the lens. The translimbal puncture at one side had destroyed only four processes and the coagulation was limited.

In another rabbit (rabbit 22, O.S.)

wherein the transcleral perforation was not so large and deep, the coagulation effects were not so marked and no hemorrhages occurred. To be positive that no hemorrhages or excessive destruction had been produced with the ordinary translimbal method, rabbit 22 was killed two days after the operation. The anatomic examination showed that four processes were coagulated, but no hemorrhage nor exudates were apparent.

COMMENTS ON TRANSLIMBAL DIATHERMY. A fistulizing operation combined with the coagulation of a small number of processes had the immediate effect of lowering the intraocular pressure. Experimentally, hypotony has been induced for as long as two months. It has proved to be a safe procedure which does not produce a great inflammatory reaction and can be repeated several times in different sections of the limbus. Usually, however, the scleral puncture closes, leaving a thin, depressed cicatrix. Ordinarily, no iridectomy was performed, so that the intact iris membrane could protect the lens from the effects of heat. However, there is no objection to an iridectomy followed by the translimbal puncture, if the latter is made quickly to avoid great heat near the lens.

In congested, glaucomatous human eyes the severe hyperemic effect of diathermy on the ciliary body and choroid may probably be added to the advantages of the fistulization. As Weekers and other authors have pointed out, it is likely that the active hyperemia produced by diathermy changes the circulatory conditions inside the eye and relieves the congestion and stasis of the inner membranes.

CLINICAL APPLICATIONS. Four translimbal operations have been made in patients suffering from old, congestive-type glaucomas. They have been successful in lowering the intraocular pressure and bringing it to normal, but, unfortunately,

the results have not been permanent and a second or third operation had to be performed. A good lasting effect was obtained, however, in a case of secondary glaucoma following a cataract operation. In general it can be stated that the use of diathermy for lowering intraocular pressure has not fulfilled the expectations that many authors, including myself, have entertained about the considerable advantages of this therapeutic method.

SUMMARY

By experiments on rabbit eyes it has been attempted to determine the physiologic bases of diathermic methods, their action on the intraocular pressure, and the damage done to the ocular structures. Vogt's method of multiple perforations of the sclera in the region of the orbiculus ciliaris had no physiologic basis, for the orbiculus has no part in the secretion of aqueous. The method produced a severe inflammation which ended in atrophy of the orbiculus, and had but little effect on the processes.

Albaugh and Dunphy's method of a nonperforating diathermy also acted especially on the orbiculus, although it did have an indirect effect on the processes. It also induced a severe inflammation which ended in atrophy.

When multiple perforations were made experimentally behind the limbus to reach the processes, the results were severe and these organs were destroyed. If the area of coagulation was extensive, intense reactions with exudates, hemorrhages, and lens changes appeared. In some cases the eye became atrophic.

The author tried to determine by direct local coagulation of a small number of processes whether their destruction could produce a prolonged hypotony. He used two routes of approach: the posterior through the sclera and the anterior through the cornea. By the former

method, after making a scleral incision as in cyclodialysis, he introduced a spatula into the anterior chamber then the diathermy electrode, coagulating the ciliary body base either with a single puncture or by moving the wire laterally. The eyes tolerated the coagulation well, and there was little inflammatory reaction. The intraocular pressure remained low for three weeks but then rose to normal. When the coagulation was more extensive, the reaction was greater, although the eye recovered completely three weeks later. The tension was very low and remained so for 17 days, after which it returned to normal. Slitlamp examination of the enucleated eyes clearly showed the extent of destruction in the processes.

Diathermic coagulations via the anterior approach were made after a corneal incision and a broad iridectomy had uncovered the ciliary body and processes. The electrode was pushed directly into the ciliary-body base above the processes. Four to five coagulations were made. The inflammatory reaction was not severe; the cornea was slightly opaque near the wound, a posterior synechia developed,

and the lens showed a linear opacity. The tension stayed low for 15 days and then returned to normal.

As these methods did not produce a lasting lowering of the intraocular pressure, the author tried to combine the limited destruction of the processes with a fistulizing operation. He called this method a "translimbal diathermy." After making a conjunctival flap, he introduced the diathermic wire boldly through the sclera, 2 mm. behind the limbus and pushed obliquely through the ciliary body until the tip appeared in the anterior chamber. The wire was left in place for a few seconds until the perforation was about 2 mm. wide. The flap was then sutured. In several rabbits he was able to obtain considerable hypotony. The scleral aperture remained open for two to three months but later closed. In some animals a filtering scar was obtained. However, the author considers the results of diathermy disappointing from the standpoint of a permanent lowering of the intraocular pressure.

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A CASE OF ATYPICAL ACHROMATOPSIA*

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INTRODUCTION

Typical achromatopsia is characterized by complete absence of chromatic color perception in association with other symptoms attributable to absence or loss of function of the retinal cones. The associated findings are as follows:

(1) Visual acuity is reduced, usually to about 20/200. Other evidences of foveal impairment found frequently but not invariably are nystagmus and a central scotoma.

(2) There is a shortening of the long-wave-length end of the spectrum and a shift in the region of maximum brightness toward the short-wave end.

(3) Exposure of the eyes to light of fairly high intensity produces rapid blinking or partial closure of the lids. This photophobia, unlike that accompanying

disease of the external eye, is apparently not caused by any marked pain nor discomfort, but is an attempt to maintain partial dark adaptation of the retinal rods.

(4) The adaptation curve, showing the thresholds during dark adaptation following exposure of the eye to light of high intensity, differs from normal. The normal curve has two distinct portions; in the first section the thresholds depend upon cone function, in the second upon rod function. In typical achromatopsia only a rod curve is present throughout the entire period of dark adaptation. The thresholds during the first 8 to 10 minutes are consequently higher than those of the normal eye.

In a small number of the reported cases of achromatopsia one or more of the associated characteristics are absent. In collaboration with Newhall in 1942¹ I reviewed the cases of atypical achromatopsia previously reported and described two additional atypical cases and one

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typical case. In one of the former there was complete loss of chromatic vision and a normal luminosity curve. In a second case there was incomplete loss of chromatic vision, normal visual acuity, no evidence of photophobia, and only a slight shift in the luminosity curve. In 1943, Lewis and Mandelbaum² reported three cases of achromatopsia in which adaptation curves were entirely normal, with two distinct portions such as are customarily attributed respectively to cone and rod response. The findings were typical in all other respects.

PRESENT INVESTIGATION

The present study reports an additional case of achromatopsia in which most of the typical associated findings were absent

lightest gray sample (N9/) was called white, N8/ and N7/ were called gray, N6/ gray or green, N5/ to N3/ green, N2/ and N1/ red. Eight loose samples, whose colors were red, orange, yellow, green, blue, and purple of high chroma (saturation) were then compared in turn with the neutral-value scale. In all but one case it was possible for the subject to find a gray which matched the color exactly. In this one case he reported that the color was slightly darker than N5/. The neutral grays chosen to match each color and the color name, assigned in each case are given in table 1. It will be noted that the subject was quite consistent in applying the name red to low-value (dark) colors and grays, the name green to colors and grays of medium value, and the name

TABLE 1

Colors of Following Munsell Specifications			are Matched to Grays of these Values	Called by these Color Names
Hue	Value	Chroma		
Red	4	12	3	Red
Red	5	12	4	Green
Yellow red	6	12	6-7	Green
Yellow	8	12	8	Gray
Green	5	8	6	Green
Purple blue	3	12	4	Green
Purple	4	12	5	Green
Red purple	4	12	4	Green

The subject was attached to a ground crew in the Army Air Forces. Complete loss of chromatic color perception was suspected from the findings on routine color-vision tests. He had some difficulty in reading the demonstration plate in the American Optical Company charts (a red 12 on a gray background) and had the unusually low score of 2 on the Color Threshold Test.³

Further tests with Munsell colors gave conclusive evidence of achromatopsia. When the subject was shown the neutral value scale in the Munsell Atlas, the

gray to light colors and grays (of high value). The value matches indicate also that reds appeared darker, greens and blues lighter than they do to the average normal eye. The reds, for example, were matched to grays which are to the normal eye, one step lower in value, the greens, blues, and purples matched to grays one step higher in value.

A further series of color matches was made using the Macbeth Illuminometer. The illuminometer was directed toward an opal glass plate illuminated from the rear to a brightness of 263 ml. Each of

the colored filters was interposed in turn between the illuminometer and the opal glass. By adjusting the brightness of the standard field of the instrument, the subject was able in every case to obtain a perfect match between the white and the chromatic photometric fields; that is, they were reported as identical in color as well as in brightness. Columns 1 and 2 of table 2 give the Corning filters used and the color

each case reported that the two fields were identical. The color names assigned to the photometric field, as before, varied with the brightness and tended to be reported as gray when above 50 ml., and as green when below this value. A comparison of the brightness matches with those of the normal subject again shows that red and orange appeared darker than to the normal eye, green and blue lighter.

TABLE 2

Filter Used	Color of Comparison Field	Brightness as Measured by Normal ml.	Brightness as Measured by Subject ml.	Color of Field Reported by Subject
None	White	263.0	253.0	Gray
Corning 5543	Blue	5.64	13.0	Green
Corning 4084	Green	39.8	51.4	Gray
Corning 3482	Orange	160.0	103.0	Gray
Corning 2412	Red	36.9	8.03	Gray "too light to be green"
Corning 2404	Red	17.9	3.21	Probably green

of the comparison field in each case. Column 3 gives the brightnesses of the comparison field as determined by an observer with normal color vision; column 4, the brightnesses as determined by the subject. After the standard and comparison

From these data the extent of the shift in the spectral-luminosity curve can be estimated only. The decrease in relative luminosity of reds and increase in that of blues and greens is not so great as

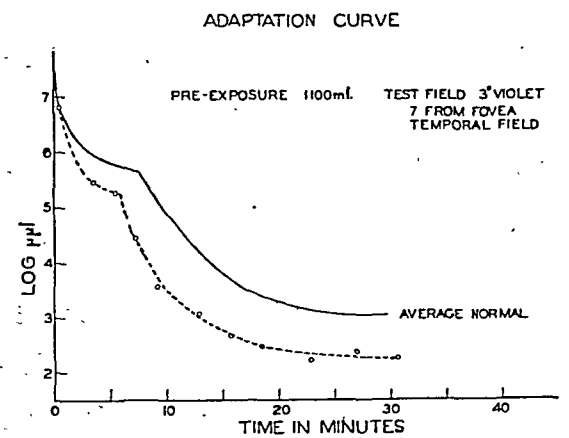


Fig. 1 (Sloan). Adaptation curve measured on the Hecht Adaptometer with a 3-degree violet test field.

fields were matched by suitable adjustment of the brightness of the latter the subject in

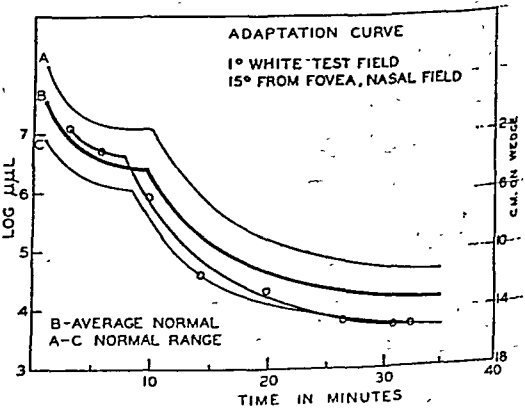


Fig. 2 (Sloan). Adaptation curve measured on the Perimetric Light Sense Tester.

would be expected if the luminosity curve of the spectrum coincided with the normal scotopic curve. It is of interest in this connection that the subject's affection would be classified under protanopia on

the basis of tests with the Rabkin Polychromatic charts, presumably because in these charts the difference in brightness between figure and background was the same for him as for one who is protano-

distinct cone and rod portions, and rod thresholds lower than the average normal values. Figure 3 gives the thresholds of the fully dark-adapted eye from center to periphery in the horizontal meridian.

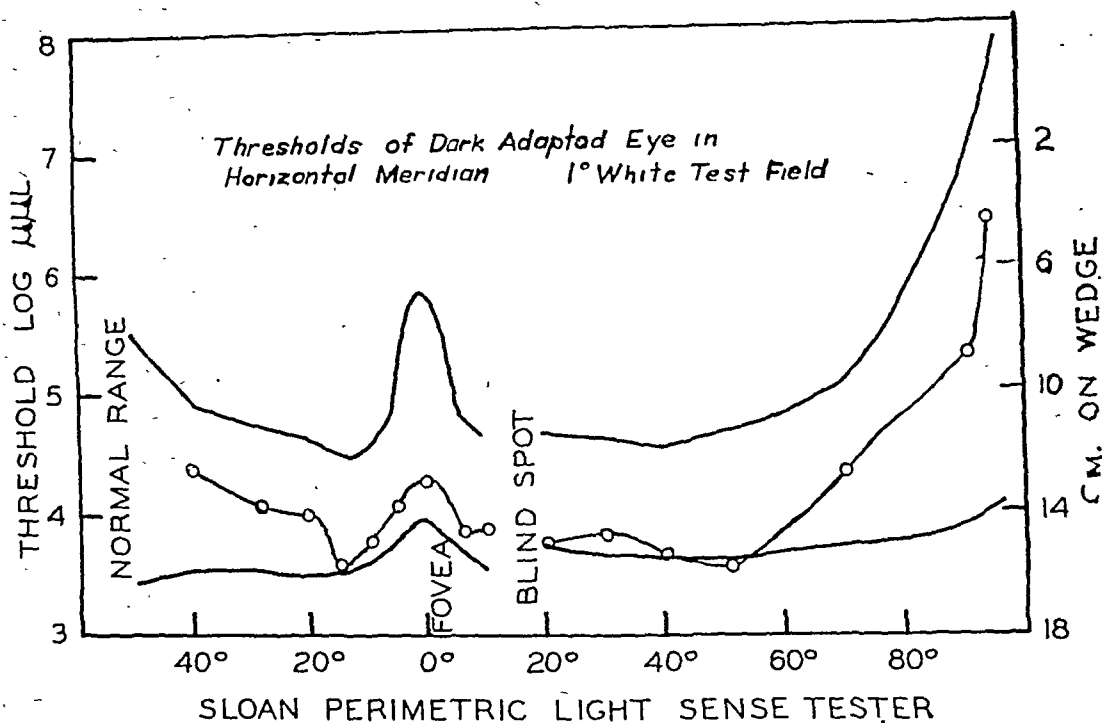


Fig. 3 (Sloan). Thresholds of fully dark-adapted eye from center to periphery in the horizontal meridian.

pic, and suggests that the shift in the spectral-luminosity curve corresponds to that found in protanopia.

All other characteristics commonly associated with achromatopsia were absent in this subject. The corrected visual acuity was 20/15 in each eye. There was no evidence of photophobia. The curve of dark adaptation after preexposure to high brightness had the usual cone and rod portions.

Figure 1 shows the adaptation curve measured on the Hecht Adaptometer with a 3-degree violet test field. Figure 2 shows the adaptation curve measured on the Perimetric Light Sense Tester⁴ with a 1-degree white test field. Both curves have

These were also measured on the Perimetric Light Sense Tester with a 1-degree white test field. The thresholds are unusually low except in the far periphery, where they are close to the average normal values.

As in normal subjects, the foveal threshold was higher than that of the surrounding regions. Additional deter-

TABLE 3
FOVEAL THRESHOLDS LOG μ L 1-DEGREE TEST FIELD

	Subject	Normal	Normal
1° white	6.24	6.05	5.58
1° red	7.39	5.55	5.29
1° blue	5.04	6.16	5.53

minations of the foveal threshold measured on the Hecht Adaptometer are given in table 3 for the subject under consideration and for two normal subjects. The fixation control was a dim point of light at the center of the 1-degree test field. This device maintains a more accurate control of fixation than does the perimetric fixation target of the Perimetric Light Sense Tester, but the presence of the fixation light may increase the threshold slightly. The threshold for white light was not significantly different from the thresholds of the two normal subjects. The threshold for red was, however, higher and that for blue lower than the corresponding thresholds of the normal subjects. These results are consistent with the previous findings, which indicated a shift in the spectral-luminosity curve toward the short-wave-length end.

The normal visual acuity and the normal foveal threshold for white light indicate that the visual cells of the fovea in certain respects function as cones rather than as rods. They differ from normal cones in having a spectral-luminosity curve intermediate between the cone and rod curves, and resemble rods in their complete lack of color discrimination.

SUMMARY

Studies are reported of a subject with complete loss of color perception and a shift in the spectral-luminosity curve. Other evidences of abnormal cone function were not found. These results and those of previous investigations indicate that no one of the characteristics commonly associated with typical achromatopsia is invariably present.

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OCULAR LEPROSY IN PANAMA

A STUDY OF 150 CASES

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The subject of leprosy has attracted medical writers since the earliest times. Accounts from the Egyptian papyrus tell of a disease resembling leprosy that was evident as early as the reign of Hesepti of the First Dynasty about 4600 B.C.;¹ the Papyrus Ebers shows that it existed in Egypt in 1500 B.C. Numerous references have been made to it in Biblical times regarding diagnosis and prevention, where it was referred to as "Zaarath." "Zaarath" has no doubt been misinterpreted by the translators' of the Bible. Outstanding symptoms such as anesthesia, contractures, nodular formations are not mentioned. The "rising" by which is probably meant eruption of any skin lesion, depigmentation, scaling, and itching are more suggestive of vitiligo, favus, psoriasis, scabies, or the acute exanthemata, the "risings" of which later would disappear after the specified period of isolation. Leprosy as we know it today probably did not exist among the ancient Hebrews. That the disease continues to stir curiosity and thought is a testimony to the bizarreness of the disease. Anyone who has worked with these patients is struck by the pathologic museum that resides in each one of them and the utter relentlessness of the disease process.

Reports in the literature on ocular leprosy have come from nearly all parts of the world where leprosy is found, yet there has been little reported in the past few decades. Leprosy was probably introduced to Panama early in the sixteenth century by the Spanish Conquistadores and later in the slave traffic. It is said that the disease first appeared in the United States about 1750 in the vicinity

of what is now Louisiana. The improvement in our precision instruments for study and the apparent variation in leprosy of the eye in other parts of the world has prompted this study of 150 cases in Panama.

The patients reside, or have resided, in the Palo Seco Leper Colony and present all the observed cases of leprosy in Panama and the Canal Zone at the present time. The census of the colony maintains itself at about 120, since the number of new cases and the number of deaths nearly balance. There are about 10 post-mortem examinations each year on patients from the colony. The superintendent of the leper colony believes that the total number of leprosy cases in Panama probably runs three or four times this number. The chance that these undiagnosed cases in the "Interior" will come under the recognizing eye of a physician is small, since their medical facilities are limited.

As Ophthalmologist to the Palo Seco Leper Colony for the past 3½ years, I have been able to observe the ocular lesions in all stages. Accurate reports have been kept of the visual acuity, and refractions have been done as indicated. Examinations of the face, lids, conjunctivas, lacrimal apparatus, and extraocular motility were made. Loupe and biomicroscopic studies of the irides and corneas, and inspections of the fundi were routinely performed. Smears from the conjunctivas and corneas were examined in 100 cases. Data were collected as to place of birth, race, age, duration, and classification of leprosy in each instance. Accurate reports on the eye are traceable



Fig. 1 (Harley). Mixed leprosy (moderately advanced).



Fig. 2 (Harley). Mixed leprosy (far advanced).

back to 1937, and these data have been included.

Different forms of treatment were tried in conjunction with systemic therapy. Over 25 operations were performed, including 5 enucleations. Histopathologic study has been made of 7 sectioned eyes. Photographs, lantern slides, and movies were made of the more interesting cases.



Fig. 3 (Harley). Nodular leprosy.

GENERAL CHARACTERISTICS, DISTRIBUTION, AND AGE

The bacillus of leprosy, discovered by Hansen in 1874, which is found in nearly all the major lesions, is presumptive evidence of its role as the etiologic agent. *B. leprae* can usually be demonstrated in all the eyes at postmortem examination, especially in the anterior segment. The bacillus is an acid-fast slightly curved or straight rod, is said to be resistant to drying, extremes in temperature, and other unfavorable conditions.

The bodies of lepers which have been dug up after three and four years yield *B. leprae* in profusion.² Arning, in Honolulu, found bacilli in great numbers in the putrid fluids of a cadaver that had been exhumed, three months after burial.

The leprosy bacillus, pathologically, induces a typical granulomatous lesion which manifests itself either as a nodular mass or a diffuse infiltrative process. The disease ordinarily assumes three forms: nodular, anesthetic, or mixed.

Nodular. This form affects all the cutaneous structures, especially the face. The leproma is made up of lymphocytes, fibroblasts, and large monocytes, with an occasional polymorphonuclear cell. The large monocytes phagocytize the leprosy bacilli, become swollen, and then take on the characteristics of "foam cells," due to the frothy appearance of the cytoplasm. These foam cells may aggregate into large multinucleated giant cells (lepra cells). However, there is no focal arrangement, and caseation does not occur, but fibrosis with shrinkage does occur.

Anesthetic. In this form there are usually no foam cells but there is an infiltration of the perineurium and endoneurium by lymphocytes, fibroblasts, and monocytes. Eventually fibrosis occurs, which destroys the nerve tissue by pressure.

Mixed. This form is a combination of the two, but manifests itself clinically in varying degrees of the nodular and anesthetic forms.

Two other types—namely, the macular and tuberculoid forms—exist, but their recognition is less clear cut and does not concern the present subject.

According to Manson-Bahr, 1935,³ nodular leprosy is more common in cold damp climates, whereas nerve leprosy occurs more frequently in warm dry climates.

In our cases none of the purely nodular



Fig. 4 (Harley). Neural leprosy.



Fig. 5 (Harley). Tuberculoidlike lesions in a case of mixed leprosy.

type was found. Twenty-six percent were classified as anesthetic, and 74 percent were mixed. The patients were classified as to place of birth, since there is strong evidence that the disease is contracted during childhood. It was interesting to note that the vast majority of patients from Panama in the past 20 years have come from two relatively localized areas in the interior of Panama; namely, Los Santos and Bocas del Toro.

POSITIVE SEROLOGY

In only three patients was syphilis definitely proved by a history of chancre, a positive darkfield examination, a positive spinal fluid, or other incontrovertible evidence. However, sera from a relatively large number of patients showed a 1- or 3-plus Kahn reaction and often a less positive Wassermann. The incidence of proved syphilis at Palo Seco is lower than that usually given for Negro and mestizo individuals in Panama from the same stratum as that from which the lepers came. Positive blood tests of Negroes and mestizos from 1924 to 1941 varied between 15 percent to 30 percent⁴ according to the year. However, it is probable that a considerable number of these persons had a positive reaction from other causes.

Each leper patient had at least five or six blood tests for syphilis, but the tests varied considerably in their positiveness and often became negative for both the Wassermann and Kahn. Nearly all the nodular cases (that is mixed) showed a positive blood test for syphilis at one time, usually picked up by the Kahn test. The neural cases, it was found, were less likely to give a positive test unless there was an acute tuberculoid reaction. Syphilis, apparently, does not alter the course of leprosy except, perhaps, to involve some structures which leprosy ordinarily does not attack.

IMMUNITY IN LEPROSY

The question of allergy has been investigated, but, as in the use of tuberculin, there are certain breaches in its interpretation which are difficult to comprehend fully and apply clinically.

Rotberg⁵ studied the reactions to Lepromin (antigen from nodules) in 1,529 individuals. He concluded that leprosy is a highly contagious but also a highly immunizing disease. The bacillary leper is the propagator of the infection, but prolonged contact with this type of case does not necessarily mean that the disease can be contracted. In countries where it is endemic a large part of the population has been contaminated and immunized. A predisposition to leprosy exists which is represented by a failure of reaction of the immuno-allergy to the bacillary invasion. The greater ratio of cases of "declared" leprosy in familial foci is due, probably, to inherited predisposition, to superinfections, and to the endemic zone of environment. There seems to be little doubt, at present, that susceptibility to the disease varies greatly in different individuals. Healthy adult individuals with good nutrition appear relatively immune to leprosy.

DISTRIBUTION OF PATIENTS ACCORDING TO PLACE OF BIRTH

<i>Country</i>	<i>Percentage</i>
Panama	70
Jamaica	10
Colombia	5
Costa Rica	5
Barbados	3
China	1
Guadaloupe	1
Haiti	1
Martinique	1
Nicaragua	1
St. Lucia	1
St. Vincent	1

The youngest patient examined at Palo Seco was 12 years of age and the oldest 85. In general, the patients who had had the disease for a considerable period of time showed the most severe ocular complications. In fact, it may be said that these patients uniformly showed varying degrees of ocular leprosy proportional to the length of their illness. Those who apparently contracted the disease later in life, or in whom it became manifest later, showed distinctly milder and less rapid ocular changes. Although there was a majority of males at the colony, no actual sex difference could be recognized. Approximately 10 percent of the patients became "smear negative" and were paroled, but 50 percent of these returned to die with the disease. Some of the patients who became eligible for parole declined to leave, preferring the "easy going" routine life of the colony to the struggle of the outside world.

OCULAR INVOLVEMENT

Reports from the literature show that the eye is frequently involved in the systemic disease process. It seems to be generally agreed that the eye presents a very real and serious complication in leprosy. However, the percentage of cases showing ocular involvement, as recorded, varies from 20 to 100 percent of all patients when the different forms of the disease are taken into account (Neve,⁶ Minder,⁷ de Barros,⁸ Wood,⁹ Borthen and Lie,¹⁰ and others). It is probably true that the disease assumes different rates of incidence and manifestations in outlying parts of the world, and this may account for the variations in the reports that have been published. It is known, for instance, that leprosy appeared in Europe about the sixth and seventh centuries and apparently spread with the Crusaders. By the twelfth and thirteenth centuries it spread

with nearly epidemic proportions, so that it was known throughout Europe. At the end of the sixteenth century, through the efforts of segregation, it was considered to have nearly died out. Practically any disease introduced to a virgin people may be expected to be more serious and entail extensive complications; so it may be with the ocular complications of leprosy in different countries.

It was noted that the lowest percentages of ocular involvement emanated from the older civilizations although the significance of this may be questioned. Some authors state that all leprosy patients will eventually have ocular complications. Grossman¹¹ stated that patients with cutaneous (nodular) leprosy always have ocular complications. Pinkerton¹² in Hawaii and Prendergast¹³ in Louisiana reported involvement of the eyes by leprosy in approximately 91 percent of cases.

At Palo Seco the figures corresponded almost exactly with those of the last two authors. Ninety percent of the leprosy patients were found to have ocular involvement, not including the adnexa. If the adnexa were included it may be assumed that in predominantly nodular leprosy all but those in the first few years of their disease have involvement about the eyes. It seems likely, as has been stated, that some form of ocular leprosy will eventually occur if the patient lives long enough. The 10 percent of eyes free from the disease were found exclusively in recent or paroled patients. It was impressive to note that of all the organs involved in leprosy the ocular lesions appeared to cause more complaints than any other.

Lopez¹⁴ calls attention to the dullness of the leper's eyes. It is indeed an observation of some value. The eyes seem to have a dull, lusterless, expressionless ap-

pearance even before notable ocular pathologic change is apparent. Perhaps this is just an outward expression of the greater or lesser degree of depression which inevitably accompanies this disease process.

It was noted that the most severe ocular involvement occurred in those patients who had extensive nodular development. In our series all these cases were classified as mixed, since there were no cases in the colony which could be diagnosed as purely nodular. Even in the anesthetic cases of long duration the ocular pathologic change seemed to be less severe.

ACQUISITION OF THE DISEASE

Even though the organism and pathologic lesions present in leprosy have been accurately described, there is, as yet, no definite idea of how the disease occurs, except that it is probably contagious. The fact that it seemed to run in families led the early leprologists to believe that the disease was hereditary. Of the numerous offspring of Norwegian lepers who emigrated to America, seven definite cases of leprosy occurred in the first generation and one of doubtful diagnosis in the second generation. It is noteworthy that although acid-fast bacilli have been detected in the placenta and cord, no children have been known to develop leprosy if removed from the parents at birth. At Palo Seco the patients are allowed to marry within the colony. The children who have resulted from these unions are known to be thus far free from the disease. The evidence is that the disease is not hereditary.

Authorities now believe that leprosy is transmitted by contagion, usually in childhood. However, the factors influencing contagion appear to vary within wide limits. A number of years must intervene, apparently, between contact of the susceptible host and the manifest disease.

Pinkerton¹⁵ stated that after the first leprosy lesion had been noted there was an average of two years of freedom before the patient became a menace to the community and was apprehended and quarantined. Many attempts have been made to transfer leprosy to man by inoculation. Most of the trials have been futile, but in one experimental and in several accidental inoculations there were positive reactions. The disease, in these instances, appeared milder and was apparently self-limited. Another case of inoculation was in a Sandwich Islander, who within a month developed a leprotic neuritis followed by death within six years. It was revealed that members of his family were lepers, so this finding nullified the experiment (Manson-Bahr³). Father Damien's (Molokai Island) was one of the few adult cases of contagion through contact on record, but even in his case the evidence was not complete.

Not only is the method of transmission in dispute but there is still much speculation as to the medium of transfer. The portal of entry for the ocular invasion is also in question. It is believed by some that the bacilli enter the eye externally from the conjunctiva or episcleral tissues. Most workers are of the opinion that the ocular infection is secondary to a hematogenous spread. The fact that the bacilli can be found in nearly all the internal organs is an outcome of the bacillemia which occurs in most cases of cutaneous leprosy. The "acute leprosy reaction" accompanied by high fever is probably a bacillemia. In favor of the hematogenous spread to the eye is an article by Fuchs,¹⁶ who found the primary ocular lesions in the anterior part of the ciliary body and major circle of the iris. This region has a rich vascular plexus such as would be a convenient receiving end organ for the bacilli. Fuchs found that bacilli may appear in healthy tissues

but did not necessarily affect the tissues. The behavior of the tissues toward the bacilli was the decisive factor. In five sectioned eyes it was shown that inflammation occurred in the perilimbal episclera and the longitudinal fibers of the ciliary muscle extending back to the ora serrata but no farther. Occasionally, healed chorioretinitis occurred, but this was unaccompanied by bacilli, thus casting doubt on its leprous origin. In all cases the cyclitis appeared to be an older inflammation than the episcleritis, which added to the evidence of an endogenous spread.

Santonastaso¹⁷ in studying eight sectioned eyes was chiefly concerned with the localization and extent of the ocular pathologic process. Assuming that there was an exogenous spread of bacilli into the eye and that the limbus was the site of selection, it might be expected that the oldest and most advanced pathologic change would occur at the limbus. This, however, does not seem to be the case, for frequently the iris and ciliary body were more advanced pathologically, thus suggesting an endogenous origin for this site. There appeared to be two factors, exogenous and endogenous, which seemed to be acting simultaneously in this disease. In some eyes one factor often predominated over the other, so that pathologically the response of the ocular tissues to the bacilli differed in age and extent. On the contrary, because other workers have been unable to find bacilli in the small vessels of the iris or ciliary body they have raised objection to the theory of blood-borne transference. Santonastaso has correlated the presence of argentophile fibers with the presence of leprous involvement in the eye. Argentophile fibers may be found especially in the submucosal layer of the bulbar and palpebral fold of the conjunctiva, uveal tract, ciliary

muscle, iris stroma, pectinate ligament, Schlemm's canal, and about blood vessels. Since the leprous involvement closely followed the distribution of argentophile fibers they have been assumed to have a real significance. However, the cornea is peculiarly lacking in these fibers. It is believed that the cornea is attacked secondarily and suffers chiefly through a toxic or trophic agent. This observation, though attractive, appears to be a coincidence rather than a reality. The disease primarily strikes the anterior segment of the eye, and it is in this region that bacilli are most often encountered. The argentophile theory makes it difficult to account for the scarcity of the disease in the posterior segment, where uveal tissues (argentophile fibers) are prominent.

Dimitry¹⁸ and others have called attention to the high percentage of ocular cases that showed marked nasal pathologic change. The cases at Palo Seco exhibited the same association. It is unusual to see any pronounced ocular complication not accompanied by varying degrees of nasal mucous-membrane ulceration and perforation. The possibility of an ascending infection by way of the nasolacrimal duct is to be considered, but purulent dacryocystitis is not seen as commonly as might be suspected, even though the cartilaginous portion of the nose is completely depressed.

VISION AND INVOLVEMENT IN AUTHOR'S SERIES

VISION AND VISUAL LOSS

In the series of 150 patients, the number of eyes examined constituted a total of 298. Twenty, or approximately 13 percent of the patients, were found to be totally blind in one or both eyes. Sixty-two, or 41 percent of the patients, had vision of 20/200 or less in one or both eyes, not correctable, which, in most in-



Fig. 6 (Harley). Corneal leproma in mixed leprosy.

stances, may be assumed to be due to the disease. In 65, or 43 percent, there was normal vision in both eyes. Sixteen, or approximately 10 percent, had normal vision in one eye. The normal vision of these patients had no bearing on the pathologic change, which was later recognized by slitlamp observation. It is impressive that the gross appearance of the eyes in so many of these cases was disproportionate to the findings by biomicroscopy. Thus 82, or 54 percent, of the patients were blind or had vision of 20/200 or less in one or both eyes. This

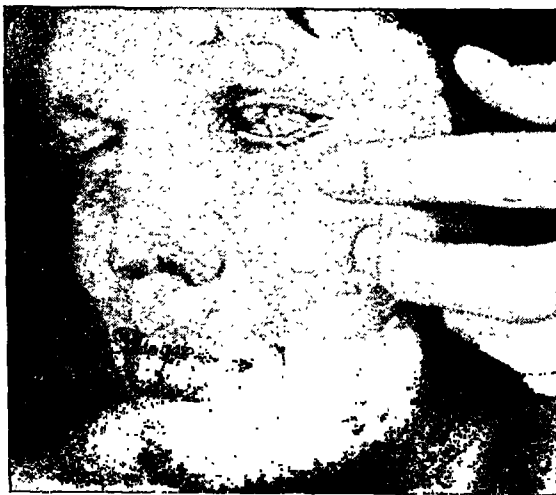


Fig. 7 (Harley). Close-up view of corneal leproma in mixed leprosy.

may be regarded as the percentage of the colony with severe ocular complications of leprosy. Neve⁶ found 13 blind eyes in 80 patients in India, and Van Driel¹⁰ collected but 7 cases of blindness in 1,300 cases examined in Sumatra. Certainly the factor of blindness must vary with nutrition, environment, stage of the disease, and medical care.

THE ADNEXA OF THE EYE

Leprosy involves the region of the eyebrows and eyelids with considerable frequency. Because this is true such involvement is probably one of the best-known signs recognized by physicians and laymen alike.

Approximately 50 percent of the patients had hypertrophy of the skin of the brows or cutaneous nodules, with varying degrees of loss of hair of the eyebrows or lashes (madarosis). This represented the percentage of patients with far-advanced nodular leprosy. Although loss of the eyebrows and eyelashes is usually given as an early and characteristic feature of the disease, this condition, as a rule, has been found in only the most developed cases. It cannot be regarded as an early sign. The hair changes begin with slight loss in the temporal regions of the eyebrows. Sometimes they become gray, splintered, or softly filamentous. The eyebrows are usually lost before the eyelashes. Frequently a few fine eyelashes persist until the last, especially along the lower lids.

In nodular leprosy, formation of nodules about the outer eyebrows is common. This spot, in addition to the ear lobes, serves as an excellent place to make a puncture for serum smears in the diagnosis of the disease. The margin of the eyelid, usually the upper, may be attacked by nodules. Sometimes these closely resemble chalazia and commonly cause localized pain. Lepromas, the size of large

peas, were found at the margins of three lids. These nodules may ulcerate. A diffuse infiltration of the eyelid margins was also seen which gave the edges a rolled thickened appearance (tylosis). Nodules are also commonly situated about the alae of the nose, on the cheeks, forehead, lips, and ears. The nodules, as they increase in size, seem to accentuate the normal skin folds and wrinkles until there develops what everyone knows as "leonine facies."

In anesthetic leprosy isolated areas of diminished or absent sensitivity occur in the skin about the eyes. They may usually be recognized by differing slightly in color from the rest of the skin. In 15 cases or 10 percent, there was paresis of the orbicularis palpebrarum (lagophthalmos), to the extent that there was incomplete closure of the lids. Fully another 10 percent of patients showed weakness of lid closure when attempt was made manually to elevate the lowered upper lid. In each case the involvement was bilateral but differed in intensity between the right and left side. The cases exhibiting lagophthalmos were in the purely neural and mixed types alike. Sometimes the entire peripheral seventh nerve on one side was involved, with the typical deformity, but it invariably seemed to affect the mobility of the lids to a greater extent. A search was made in each case for a nodule over the affected nerve branch, but none was ever demonstrable. The affection appeared to be a pure neural one and curiously involved the lids out of proportion to the other structures. With the lagophthalmos occurred relaxation and atonicity of the lower lids, commonly resulting in a paralytic ectropion. Ectropion was found in 11 of the 15 cases of lagophthalmos. In the other cases eversion of the lower lid will doubtless develop as time goes on. Exposure keratitis, excessive lacrimation

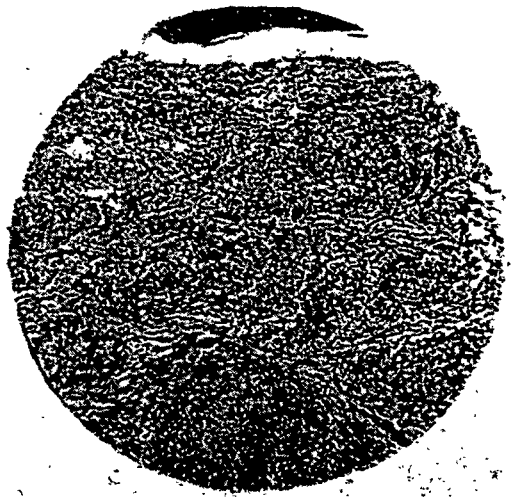


Fig. 8 (Harley). Section of leprosy skin. Masses of epithelioid cells and lymphocytes have collected beneath the surface epithelium.

with tears spilling down the cheeks, and loss of the natural protective barrier which the lids afford are the usual sequelae of such a complication.

Certain areas of the skin which appear to be free from nodules in skin leprosy have been noted. One of these is located in the upper and lower folds of the lids.

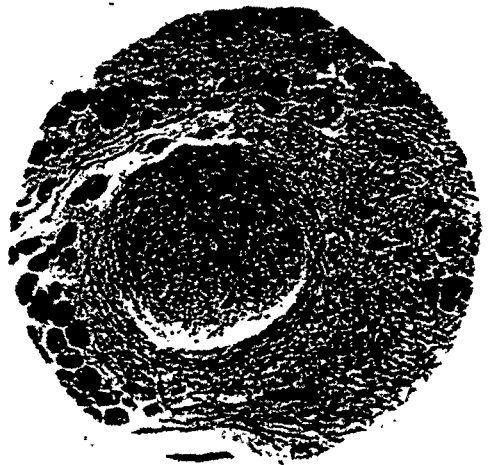


Fig. 9 (Harley). Section of peripheral nerve. Perineural and endoneural cellular infiltrations which are gradually being replaced by connective tissue.

No nodules were ever found in these folds, which are protected so well by the orbital rim. The protection thus afforded to these skin areas appears to play a dominant role and suggests itself strongly as a prophylactic measure. This protective measure has also been advocated by Valle.²⁰ At Palo Seco, where there is a predominance of the Catholic faith, it has been noted that particularly troublesome nodules have developed just below the knee. Apparently trauma as well plays a role in the formation of nodules.

Prendergast¹³ pointed out the relatively common occurrence of xanthelasma of the adnexa among lepers. This condition was found to be associated with a disturbed cholesterol metabolism. No xanthelasmas were seen in our patients, though perhaps the nearly universal dark pigmentation made this condition less recognizable.

A purulent dacryocystitis was seen in four cases but it is suspected that involvement of the tear sac is much more common than this figure would indicate. Stricture or other occlusive phenomena of the nasolacrimal duct which leads to a frankly manifest tear-sac infection is probably always secondary to nasal pathologic change. The complete collapse of the tip of the nose seemed to cause fewer complete duct obstructions than might be imagined.

CONJUNCTIVA

A chronic conjunctivitis occurred in 60, or 40 percent, of the 150 patients, whereas in only 20 percent was the discharge sufficiently annoying to evoke complaints from the patient. The conjunctivitis in all instances closely resembled a chronic catarrhal type with profuse mucopurulent discharge. In the other 20 percent the conjunctivitis consisted chiefly of a chronic injection of the conjunctival vessels, espe-

cially in the exposed portion between the lids and about the limbus. The ease with which far-advanced patients could tolerate the profuse mucopurulent secretions was probably due to the partially diminished sensitivity of the conjunctiva and cornea which occurs in individuals with lagophthalmos in the neural and mixed types of leprosy. However, complete absence of sensation of the conjunctiva was never demonstrated.

Duke-Elder²¹ states that nodules appear with great frequency in the conjunctiva in the nodular and mixed forms. However, Pinkerton and Prendergast express the opinion that the conjunctiva shows little involvement and appears to be one of the fairly immune ocular tissues.

Only two lepromatous plaques were found in the series of cases studied at Palo Seco. These occurred on the palpebral conjunctiva of the upper lid in conjunction with a particularly severe conjunctivitis as flat, infiltrated, irregularly circular areas with an ulcerated center. Leproma of the limbus will be considered with the involvement of the cornea.

Conjunctival smears were made from the inferior cul-de-sac in 100 cases. Eight smears were found to contain acid-fast bacilli. Fuchs mentions that Arizumi found bacilli in the tears of 66 percent of the patients. Riad²² found the lacrimal secretion negative in 108 cases as did Rogers and Muir²³ and Van Driel in their cases. The wide variation in these findings suggests that the bacilli may occur in the conjunctival secretions as an incidental finding from the skin and nasal secretions, internally from the episcleral tissues about the limbus, or from the blood stream. One fact remains clear, however; namely, that the conjunctiva is apparently more immune than the other ocular structures.

Thirty, or 20 percent, of the eyes contained pterygia which for the most part had an atrophic type of head and did not require surgical treatment. They appeared more prominent, owing to the conjunctival injection. Considering the relative frequency with which pterygia occur in the general population throughout Panama, the question of its presence as a complication may be dismissed. One patient showed near the temporal limbus a Bitot's spot which disappeared following the administration of vitamin A for 10 days.

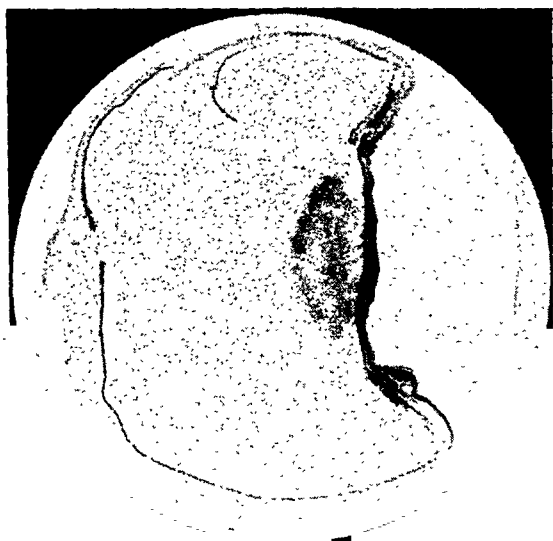


Fig. 10 (Harley). Leprous keratitis and iridocyclitis.

CORNEA

The cornea appeared to be the most vulnerable of the ocular tissues that succumbed to leprosy. Involvement of this structure was recognized in 87 cases and frequently was the only site in which any pathologic change could be seen. Elliot²⁴ and other investigators have classified three principal lesions: (1) pannus or infected granulation tissue which extends in from the limbus, (2) a superficial punctate keratitis and, (3) a deep interstitial keratitis.

The most commonly observed corneal



Fig. 11 (Harley). Small leproma of the cornea. Note the cellular infiltration beneath the corneal epithelium.

lesion was superficial keratitis, which occurred in over 34 percent of all cases. This usually began as a light milky haze punctuated by tiny white dots at the superior or superior-temporal limbus. The lower margin was usually well delineated by a wavy line, and the whole involved area gave the impression of finely pulverized "chalk" or "flour" dust, as has been described by other observers. The lesion showed a generalized haze into which were sprinkled tiny aggregations



Fig. 12 (Harley). Corneal leproma. Higher-power view of figure 11.



Fig. 13 (Harley). Leprous interstitial keratitis. Note irregular thickening and iris atrophy.

of pinpoint white dots. Many small vascular loops often crossed the limbus to enter the lesion beneath Bowman's membrane. In the majority of corneas the lower limit was 2.0 to 3.0 mm. above the pupillary center of the cornea, so that vision was not impaired and the patient was unaware of the lesion hidden by the upper lid. These lesions were also observed to arise from the nasal and inferior limbus. The superficial keratitis of leprosy may be easily overlooked. It is hidden under the upper lid and usually requires good light and magnification such as a slitlamp provides. Trantas²⁵ describes an epithelial and subepithelial keratitis. The former is transient and disappears in a few days, leaving the subepithelial form which is so commonly observed. That both forms are simply phases of the well-known superficial leprous keratitis needs no further substantiation. The latter term should be used to cover both forms. This form of superficial punctate keratitis may be regarded as one of the most diagnostic lesions of ocular leprosy—the other being

the tiny lepromata occurring in the iris, which will be referred to later.

Histologic examination of these corneas showed aggregations of round cells and polymorphonuclears beneath Bowman's membrane, leaving the corneal epithelium fairly well intact. Lepra cells were identified; aggregations of lepra bacilli have been described (Suganumo and Hojo²⁶). The lesions resemble those seen in cutaneous leprosy. The keratitis has been observed to thin out as it approaches the center of the cornea, which, perhaps, accounts for the good vision that often seems out of proportion to the corneal haze.

In 23 cases a frank interstitial keratitis was recognized. This appeared indistinguishable from luetic interstitial keratitis. King²⁷ states that such interstitial involvement does not tend to become less dense with time as does the luetic type. There were five other cases in which a grayish infiltration was present in the periphery, resembling an arcus senilis. However, in these cases vascular loops were present over the limbal border, and they may have represented the beginning of future interstitial keratitides. In 12 additional cases vascularization extending 1.0 to 2.0 mm. into the corneal substance was noted.

A frank pannus was recognized in

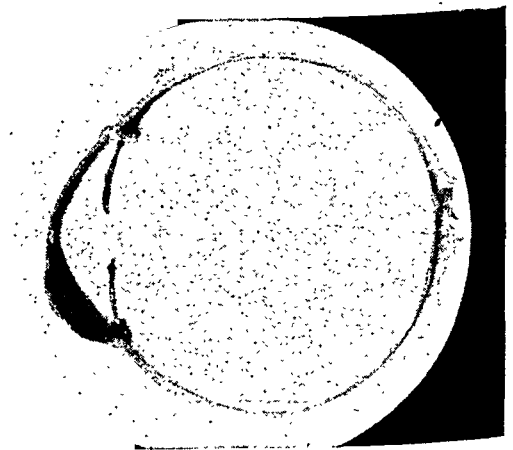


Fig. 14 (Harley). Larger leproma of cornea.

seven cases but was in no way different from the pannus seen in other conditions. The granulation was anterior to the cornea but destroyed it as the granulating mass descended. This was evidenced by the vascularization and area of infiltration that preceded it.

The most unusual lesion of the cornea was the giant leproma that occurred in three cases. In each instance it was engrafted on the cornea from a superficial keratitis and looked like a massive epithelioma. Scrapings from these lesions showed them to be teeming with lepra bacilli. Histologically, the corneal epithelium was epidermalized and occasionally ulcerated. Bowman's membrane was generally absent, and calcium deposits were present in its remaining fragments. Inflammatory granulation tissue intervened between the normal epithelium and substantia which was involved. Infiltrating the mass were lymphocytes, plasma cells, polymorphonuclears, and predominantly large foamy wandering cells. It has been suggested that the pathologic corneal changes represent different stages of the same process, and this may be true. Or, perhaps, the different corneal lesions are a result of the varying grades of "tissue resistance" to be found in the host. Six lepromas were situated at the limbus, a relatively frequent site, probably owing to the rich vascular supply at this location. Leprous keratitis is further characterized by its indolent nature without the usual inflammatory reaction.

Gabriélides²⁸ and Pillat²⁹ found bacilli in superficial corneal scrapings and emphasized this point in the diagnosis of ocular leprosy. However, in our cases it was not possible to demonstrate bacilli in superficial scrapings where only the epithelium was removed. Bacilli were, of course, present in the cornea, but it was necessary to scrape to or include Bow-

man's membrane in order to show them easily. This point was borne out by their location histologically.

The "beading" of the corneal nerves seen under high magnification is an interesting sight and easily overlooked. It was found in five cases but may be more common than this.

Corneal anesthesia is stressed almost universally in the textbooks. Yet, on repeated testings, it was possible to demonstrate this satisfactorily in but two far-advanced cases, in which the eyes were phthisical. When a small wisp of cotton was used, a relative loss of sensation was shown in a small number of cases (5). Still, when the cornea was lightly touched with a sharpened toothpick a sensation of pain was easily evoked. In general, it would seem that in the cases observed at Palo Seco complete corneal anesthesia is a rarity. De Barros⁸ of Brazil noted the same persistence of corneal sensation and suggested the need for uniform testing material, such as Von Frey's hair.

UVEAL TRACT

Second only to the cornea, the iris is the structure most frequently involved clinically in ocular leprosy. The most common form of iritis is the chronic recurrent inflammation which insidiously recurs until the most severe sequelae have risen. It comes on typically at one- to six-month intervals, lasting one to three weeks at each attack, depending on the treatment instituted.

Iritis or its sequelae (posterior synechia, ectropion uvae, anterior capsular pigment deposits, or lepromas) were recognized in over 50 percent of the cases. It was usually bilateral and at about the same stage, although the acute recurrent attacks rarely involved both eyes at the same time, except when in conjunction with the "acute lepra reaction." This lepra

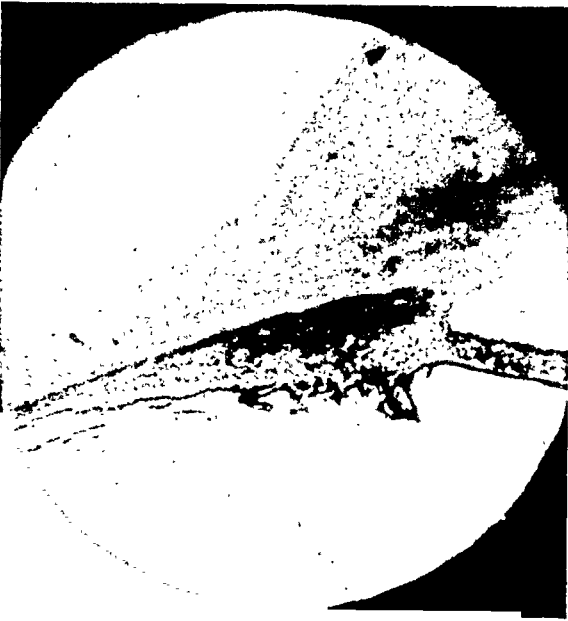


Fig. 15 (Harley). Iris angle in leproma section. Note the infiltration and atrophy of the ciliary body. The drainage angle is completely obscured.



Fig. 16 (Harley). Leprous iridocyclitis. The ciliary body is atrophic and the processes are edematous.

reaction is a hyperpyrexia state accompanied by cellulitis-like areas on the skin and supposedly a transient bacillema. Van Poole³⁰ also noted the occurrence of iritis with the acute lepra reaction.

Iris atrophy is a common finding in the older cases. This is represented by a "flattening" of the iris pattern as a whole

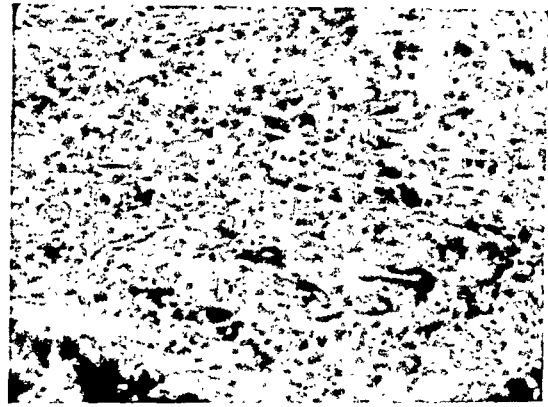


Fig. 17 (Harley). Leprous cyclitis. Within the ciliary body there are some rather large round and oblong basophilic vesicular bodies. These appear to be encysted and often included within multinucleated giant cells. Acid-fast stain reveals *B. leprae* in the encysted body.

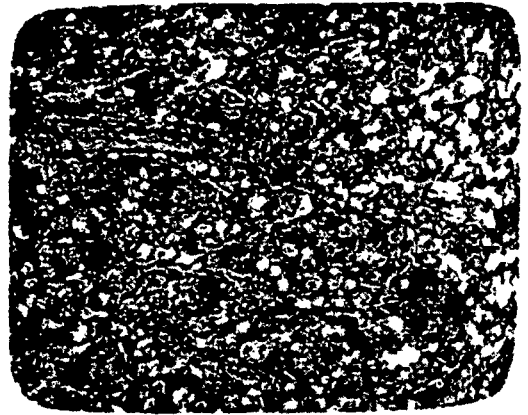


Fig. 18 (Harley). High-power section of corneal leproma. Lepra cells in corneal leproma.

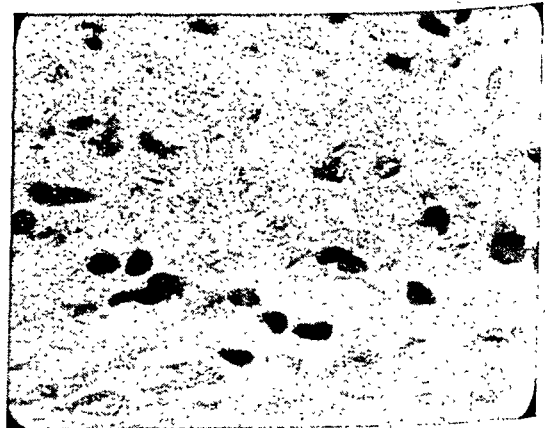


Fig. 19 (Harley). *B. leprae* in corneal leproma.

and loss of the anterior iris architecture or stroma. In the flat irides a peculiar fine, grayish fibrosis can be seen throughout the interstices of the stroma. Keratitic precipitates and cells are frequently seen under the slitlamp when with ordinary inspection the eye seems quiet.

The most fascinating slitlamp picture of the iris was the tiny lepromas which were seen in over 26 percent of the cases. They occurred always on the background of an old iritis. Typically, they were grayish-yellow, pedunculated, pin-point-sized bodies about the pupillary rim of the iris. However, they occurred deeper in the iris stroma throughout the iris and sometimes in tiny clusters. More rarely they may be seen about the periphery of the iris near the corneoscleral junction.

In two cases larger lepromas were noted. These also stood out from the anterior surface of the iris near the iris angle, and one measured 2.0 mm. in diameter. It developed to this size within one month and then completely regressed within nine months, leaving an atrophic scar in its place on the iris. Incidentally, this patient had a giant leproma of the cornea of his other eye and his brother also had a leproma of the iris which later melted in similar fashion.

It is natural to assume that the ciliary body and at least the anterior portion of the choroid would be involved, although this is perhaps more difficult to demonstrate clinically. It is probably likely, as other writers have suggested, that bacilli come to the ciliary body via the blood stream and diffuse onto the iris or back to the choroid.

Histologically, the sectioned eyes showed infiltration of the ciliary body, iris, and anterior choroid by plasma cells, large mononuclears, and lymphocytes. Leprosy cells and bacilli were also demonstrated. The ciliary processes were some-

times found to be adherent to the posterior iris surface, and often atrophy of the ciliary body was easily demonstrable. Cyclitic membranes were present in far-advanced specimens. The pathology of the choroid was always limited to the anterior portion and closely resembled that found in the ciliary body, but perhaps less marked. Leprous involvement of the ciliary body causes destruction of the zonule and subluxation of the lens.

Iridectomy was performed in a few instances to see if this might lessen the attacks of iritis. The iris was found to be exceedingly friable, and pigment readily diffused throughout the collapsed anterior chamber.

Contrary to what one might suspect, secondary glaucoma is not common clinically. Only in two instances was increased intraocular pressure encountered. Even though medication has since been discontinued in these cases, no further tension increase has been noted. This infrequency of glaucoma has been observed by others. It has been stated that it is due to the atrophy and fibrosis of the iris and pectinate ligaments (Kirwan³¹). However, two of the sectioned eyes showed depression of the lamina cribrosa, and a diagnosis of secondary glaucoma was made.

Another interesting observation, perhaps associated with the iris atrophy or possibly due to the direct neural involvement in leprosy, was the lack of response of the leprosy iris to atropine. Even in eyes apparently free from synechiae, the poor dilatation obtained from atropine was noteworthy. This fact became especially disconcerting when one tried to get a satisfactory dilatation in cases of iritis.

SCLERA

Leprosy of the sclera appears to be nearly always secondary to limbal involve-

ment and reacts to the inflammation through contiguity of structure. The limbal and conjunctival lepromas were invariably accompanied by episcleral injection. Likewise, in some of the conjunctivitis there was persistent episcleral injection after the instillation of adrenalin 1:1,000. However, one would hesitate to consider these as true cases of episcleritis on the basis of the adrenalin test alone. A leproma of the sclera extending from the 11- to the 2-o'clock position occurred in one case. It gradually receded until an atrophic area resulted. At the present time this area has become a bluish staphyloma, and the condition remains stationary. None of the histologic sections showed infiltration into the sclera proper.

LENS AND VITREOUS

Lens opacities occurred in 29, or approximately 20 percent of cases. In practically every case they developed as a complication of a plastic iritis. One dislocated lens was seen, but this was in a man who had chronic bronchitis with severe paroxysms of coughing. Vitreous opacities were exceedingly uncommon, even in old cases of healed choroiditis. The pathologic change in the lens did not differ from that usually seen in cataracts secondary to inflammation.

EXTRAOCULAR MUSCLES

One case of divergent strabismus was seen, and this was secondary to a central choroiditis. None of the cases studied revealed any outstanding abnormality of ocular motility. Apparently neural involvement of the third, fourth, and sixth cranial nerves must be exceedingly rare if it occurs at all.

THE FUNDUS

The ophthalmoscopic examinations of 50 patients produced entirely negative re-

sults. Among the other cases, 8 showed evidence of old healed chorioretinitis—in 5 it occupied a central position and in 3 it occurred in the periphery. None of the choroiditis seen was in any way typical of a specific disease process.

Three fundi exhibited massive colloidal deposits and three others showed small colloidal deposits throughout the periphery. Venous sheathing was noted in one case. A mild hypertensive sclerosis was recorded in seven cases of West Indian Negroes. Hypertensive sclerosis of retinal arterioles is unusual in Panamanians.

Retinal detachment was observed in three cases; one gave a definite history of trauma whereas the other two suggested leprosy as the cause. These latter two eyes have not been obtained for pathologic study as yet, but a cyclitic membrane may have been responsible for the detachments. Two of the sectioned eyes showed detached retinas clearly associated with cyclitic membranes.

Primary optic atrophy was present in one case, but this was a proved case of central-nervous-system syphilis.

Pallor of the optic nerve in the absence of glaucoma was observed in six cases. The pallor was chiefly temporal, and the vision was rarely better than 20/200. These cases were regarded as residual to a previous optic neuritis. None of the sectioned eyes showed any involvement of the optic nerve. Van Poole found 49 cases of optic neuritis in 206 patients, or 23 percent. It was described as transitory, in association with acute reactions or high tissue allergy, but other posterior-segment lesions were rare.

The frequency of involvement of the posterior segment of the eye has been the subject of a considerable difference of opinion. Neve considers the choroid free from attack except at its anterior attach-

ment to the ciliary body. Trantas found punctate lesions with pigmentary proliferation in the peripheral fundi in a large number of the cases that he observed. He found the retinal lesions in the extreme anterior portion at the ora serrata. They are described as round white spots such as are seen in albuminuric retinitis. Digital pressure was necessary to bring out these lesions. Rubert³² reported changes in 23 percent of his cases. At Palo Seco choroiditis of a nonspecific character was recognized in a little more than 5 percent of patients. Fernández in 250 cases never found the optic nerve involved and only rarely observed lesions of the retina and choroid. De Vincentiis found the retina and choroid normal as far as the ora serrata in 300 fundi examined. Jeanselme and Morax³³ found changes in a leprosy eye in the anterior part of the retina close to the ora and a small nodule lying next to the wall of a terminal arteriole. Gytoku³⁴ studied 30 enucleated eyes histologically and concluded that lesions of the fundi were rare. Huizenga³⁵ and Kirwin examined many leprosy eyes and concluded that practically all ocular leprosy lesions were anterior.

Prendergast emphasized that a relatively large number of eyes in his cases failed to dilate with atropine sufficiently to allow a satisfactory examination of the periphery. This "atropine resistance" has been noted in a similar large percentage of leprosy irides here. However, a subconjunctival injection of atropine, cocaine, and adrenalin frequently induced a prompt dilatation. It was the impression that peripheral synechiae near the base of the iris were often responsible for this poor response to 2-percent topical atropine.

Ophthalmoscopically one fact was outstanding. A comparison of the degree of

involvement between the anterior and posterior segments of the eye in leprosy was striking. Leprosy, characteristically, involves the anterior segment of the eye.

TREATMENT

MEDICAL

As in the general treatment of leprosy, a number of drugs have been applied in ocular leprosy and almost an equal number have been found to be of no genuine usefulness. However, a few therapeutic agents have at least stood the test of time and are indicated in certain leprosy ocular disorders. Treatment is difficult to evaluate, since by the very nature of the disease there are periods of remissions when the patient feels quite well and even fancies that his eyes and sight have improved. Ocular leprosy appears to advance in waves—each wave advancing the disease process just a few steps further until vision is eventually lost.

Since the Colony at Palo Seco is run as any other community, medical treatment is not compulsory. The older patients have been seen by so many different physicians and have tried so many different medications that the general attitude is one of hopelessness or at least resignation. It was only over a period of months that an adequate clinic attendance for ocular treatment was instituted. Coupled with the lack of faith in treatment there is difficulty in getting the patients to carry out instructions over a sufficient length of time for anticipated results. The attitude of my patients often struck me as a general apathy toward drugs but an earnest desire to cooperate with me as a friend.

Nearly all the patients have taken, or are taking, chaulmoogra oil or its derivatives. The oil is expressed from the seeds of *Taraktogenus kurzii*. It is ordinarily given by intramuscular injection,

3 to 10 c.c., or occasionally by mouth in the dosage of 2 drops to 2 c.c., depending on the tolerance of the patient. Mixed ethyl esters of the oil are used regularly, and chaulphosphate (water-soluble chaulmoograte) has been used in a small number of cases for a short time. The beneficial results are apparently transient. Local injections of the ester into nodules about the eyes causes scarification and disappearance of the nodules, such as any other sclerosing solution might perform.

Aniline dyes with and without mercury, serum from cultures, and arsphenamine were without real benefit in leprosy.

Large doses of thiamine chloride injected intramuscularly and given by mouth may be of value in reducing pain in the peripheral neuritis.

In conjunctivitis, especially of the severe purulent type, a 2-percent aqueous solution of mercurochrome appeared to be effective in reducing the discharge and making the patient much more comfortable. There is a general preference for colored medicines among these people and for this reason, perhaps, mercurochrome was used more regularly than clear solutions. A 5-percent sulfathiazol ointment applied night and morning helped to keep the conjunctivitis under control.

It was mentioned previously that the conjunctivitis encountered was probably of nonleprous origin. For this reason it might be expected that any of the reliable medications used for purulent conjunctivitis would be useful.

The leprous keratitides were treated in all stages of development. Five-percent ethylmorphine hydrochloride or 2-percent quinine bisulphate ointment were found to have no effect in improving the cornea or even stabilizing the process. Corneal ulcers, though not commonly seen, respond quickly to the usual treatment. Exposure keratitis due to lagophthalmos was

aided by canthoplasty. Xerosis of the cornea and Bitot's spots near the limbus responded readily to vitamin A.

Sol. thyroxin (Squibb) used locally in drops was reported as giving fair results in clearing corneal infiltrates in 4 of Prendergast's 17 cases, although 11 patients reported having better vision. Similar series were tried at our colony. Although 80 percent reported better sight after 49 days, actual improvement by slit-lamp observations could be seen in but half this number. All of the eyes prior to treatment showed a measurable amount of superficial keratitis and one eye of each patient was kept as a control. The visible amount of improvement was small but so far it has been the most encouraging drug used. It is said to act locally by increasing cell metabolism and tissue repair.

Chronic recurrent iritis was one of the most difficult problems at the colony. In many cases the iris had previously been the site of inflammation and was partially bound with synechiae. Even when visible synechiae were not present atropine worked poorly, as previously mentioned. Scopolamine HBr has but little better effect. It was found that intramuscular milk injections, intravenous triple typhoid, and intramuscular diphtheria toxoid were effective in the order named for the recurrent attacks.

These foreign-protein injections also seemed to exert a beneficial effect on the patient as a whole. Contrary to what I first anticipated, the patients began asking for more injections when they first began feeling twinges of pain in their eyes. The foreign protein lessened the duration of the iritis by at least half. High doses of salicylates were of no benefit in chronic iridocyclitis. Mercury and iodides in the form of mixed treatment caused nodules to ulcerate and the medication was soon discontinued.

Lenses were prescribed when requested by the patients, often with surprising improvement in the visual acuity. Glasses are a great vogue among West Indian patients even when the beneficial effects are scarcely sufficient to warrant their purchase. Photophobia is a common complaint as a result of the tropic glare and the ocular pathologic change; ground dark glasses and eye shades have been advised in all instances. These sun glasses provide considerable relief and may even act as a protective mechanism.

Many forms of medical treatment for the eyes seem to work a beneficial psychic effect on the patient during the time that the ocular disease is not actively progressing. However, as soon as there is a subacute recurrence the patient usually stops his treatment, since to his mind it has made him worse.

Faget, Pogge, *et al.*³⁶ have reported on the use of Promin in leprosy. They found leprous punctate keratitis improved in two cases and observed less frequent attacks of iritis after the use of Promin; improvement in vision occurred in one patient. Promin is being used on a series of patients at Palo Seco at the present time. It would be ideal, of course, to use a drug for leprosy which would inhibit or kill the bacilli. It may prove to be that Promin or another chemotherapeutic compound will act more efficaciously against the disease.

A group of French scientists, who for many years experimented with possible treatments for leprosy, feel that they have at last discovered a probable cure for this disease.³⁷ This research group, headed by Drs. Grimes and Pierre Boiteau, has just issued a scientific report on the successful treatment of leprosy with the use of a new kind of glucose extracted from "hydracotyle asiatic," a wild plant of the carrot family which grows in

Madagascar. As early as 1937 Boiteau and Grimes attempted to use this plant in leprosy, but as the plant's chemical composition was then little known, the extracts that were employed could have proved fatal. Then, in 1939, Dr. Bontemps, who was working in the leprosy research laboratory in Tananarive, discovered a new glucoside which he called "asiaticocide." Less poisonous, "asiaticocide" is insoluble in water, only slightly soluble in alcohol, but can be satisfactorily dissolved in pyridine. After extensive research work Boiteau succeeded in making a solution that could be injected into the blood stream, and further experiments proved highly successful. According to the hypothesis of Boiteau and Grimes, "asiaticocide" acts as a solvent on the waxy part of the microbe. Once this is accomplished the bacillus can be easily destroyed by the human organism itself or by appropriate medication. Remarkable results have been obtained in hospitals. Ocular lesions have been cured in cases wherein the inner chamber of the eye has not been attacked. It has been noted that the nodules and ulcers, which are so characteristic of the disease, yielded readily to the treatment and healed. It is stated that crippled nerve cases require longer treatment, but react favorably to the use of "asiaticocide."

SURGICAL.

Surgery of the leprous eye does not differ from other eye surgery except that one is working with a chronically progressive disease. Therefore, the basic philosophy of the ophthalmic surgeon dealing with leprosy differs to this extent. He is interested in any procedure that will postpone the day of visual loss or may assuage the ocular complaints of his patients, no matter how temporary the relief may be. One cannot afford to

take the attitude of hopelessness and be a good physician among the lepers. Anything but a genuine interest in their plight is quickly detected by these patients, many of whom are unlettered.

Surgery of the lids probably gives the most gratifying results. Secondary to orbicularis paralysis with atony of the lower lids the formation of an ectropion is common. Excessive tearing and macerated lids with exposure keratitis are the usual complications. An ectropion repair, utilizing the Kuhnt-Szymanowski technique, was successfully performed on six lids. All but two have remained in a good state of repair. In these latter two cases the puncta have begun to reëvert due to increasing relaxation of the lower lid. Further removal of skin triangles will reapproximate the puncta. Pinkerton¹² has reported on the successful use of his technique for ectropion repair, which closely parallels the Kuhnt-Szymanowski technique.

Blepharochalasis with a nodule in the most dependent portion has been seen. These are sometimes pendulous to the extent that they interfere with vision. Removal of the redundant skin and re-suturing appears to be sufficient.

Chronic dacryocystitis cases are usually surgical problems. Dacryocystectomy is performed when drainage and irrigation are of no avail. A dacryocystorhinostomy is not indicated, owing to the prevalence of infection in the nasal mucous membrane.

Extreme gentleness is necessary in the removal of the tear sac, since the lacrimal bone may be necrotic. In my first tear-sac extirpation I found the tip of my instruments inside the nasal vault despite what I considered gentle manipulation. An external fistula was formed which later was closed by topical application of 50-percent silver nitrate.

Enucleations were performed in five instances; four in recurrently painful blind eyes and the other in a case of a giant leproma of the cornea. The corneal leproma peeled easily at the line of cleavage but the eye was subsequently removed, since it was totally blind. The sockets would easily accommodate a prosthesis. However, by the time patients have reached this stage the loss of their fingers makes manipulation of a prosthesis impossible and they prefer an eye pad or dark glasses.

Pterygia were successfully transplanted in several instances. Yet, as Pinkerton has so well stated, "there is so much to be done for the patient that pterygia are rarely touched unless . . . they are growing to the point of visual disturbance."

Cataract extraction was performed in three cases. In two cases I waited a year in an endeavor to lessen the chronic iritis as evidenced by posterior synechiae and keratitic precipitates. The iridectomy was done corresponding to the clearest part of the cornea. There was visual improvement in each instance, although far below what one might anticipate from an uncomplicated cataract. A broad iridectomy with attempted release of synechiae was carried out in two other cases. Discissions were done on two patients who had after cataract.

It is of interest to know that the leprous eye withstands surgery well despite a recognizable amount of chronic inflammation. In fact, of the intraocular surgery performed it is believed that most of the eyes now appear to have less inflammation than prior to surgery. It has been previously observed and mentioned that leprous eyes seem peculiarly immune to the ordinary organisms. Questionable aseptic technique often put this to a severe test. There were no postoperative infections in any case.

It was also observed that despite all the blind and phthisical eyes that were seen very few patients complained. Diabolical as it may seem, as long as any sight persisted a chronic recurrent inflammation attacked and reattacked their eyes. Often the phthisical eyes became less painful and less inflamed after all the damage had been done.

It is to be remembered that ocular leprosy has the same course as the general disease, so that palliative measures are the chief resort, at our existing stage of information.

SUMMARY

1. The effect of leprosy on the eye has been studied in 150 cases in Panama.
2. Seventy percent of the patients were natives of Panama, the remainder came predominantly from the bounding countries and the West Indian Islands.
3. Ninety percent of the patients of the leprosarium were found to have ocular involvement.
4. Impaired vision is common in leprosy. Thirteen percent were totally blind

and an additional 41 percent had vision reduced to 20/200 or less.

5. The anterior segment of the eye is by far more frequently involved than is the posterior segment.

6. Superficial punctate keratitis or pinpoint lepromata of the irides are so typical as to be diagnostic of ocular leprosy.

7. Glaucoma is not common.

8. Absolute corneal anesthesia is rare, but relative loss of corneal sensitivity does occur.

9. Prophylaxis for leprosy eyes through protection with dark glasses or goggles is indicated. The factor of protection has been underemphasized in the past.

10. Therapy is largely confined to palliative measures.

11. Solution thyroxin used topically may be of aid in helping to clear corneal infiltrates.

12. The leper withstands surgery of the eye better than one might suspect. Surgery of the lids produces gratifying results.

Gorgas Hospital.

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SUPERFICIAL PIGMENTATION OF THE CORNEA

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Pigmentation of the superficial layers of the cornea has not been described frequently in scientific literature and for this reason, perhaps, has been considered rare; whereas pigmentation elsewhere in the body surface has been accepted as a common occurrence. The following observations had their origin during the study of the clinical pathology resulting from the action of chemical-warfare agents on the eyes and are presented for their medical interest and to add to the fund of general knowledge. It is hoped that complete correlation of this subject with that of pigmentation of other epithelial membranes will thus be aided.

Pigmentation of the superficial layers of the cornea has been described in normal eyes in senility, congenital melanosis, after severe infections such as trachoma and keratitis eczematosa, and in avitaminosis A. It was previously our opinion, based on the study of reports of extensive series of cases, that pigmented lines in the superficial cornea were rare.^{1,2} Frequent appearance of such pigmentation following chemical injury stimulated

our search in other conditions and resulted in observing it in several unrelated pathologic states.

The morphologic characteristics of the pigmentation seen have been those of Stähli-Hudson lines, Fleischer rings (as seen in keratoconus), crescents, oblique lines, and amorphous pigment deposits (figs. 1, 2, 3, 4).

The first of these needs no explanation; it was seen in three types described by Vogt (green-brown, ochre-yellow, and colorless). Since these so-called types have been seen to develop from the colorless to the most colorful in the same lesion, without change in shape, we feel that they are the results of the same abnormality and represent merely stages in development.

The Fleischer rings observed have all been incomplete and otherwise exactly as described as occurring in keratoconus.

A search through the available literature revealed no exact reference to the crescents of pigment. These occurred near the inferior corneal limbus but were separated from it by two or three milli-

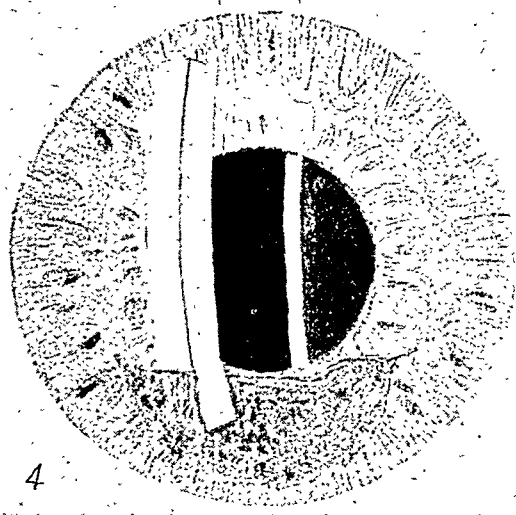
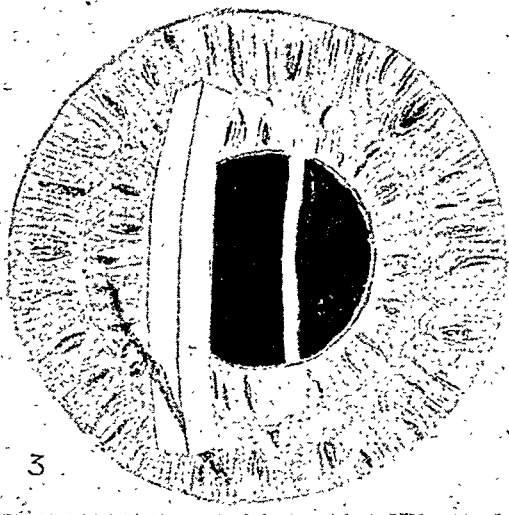
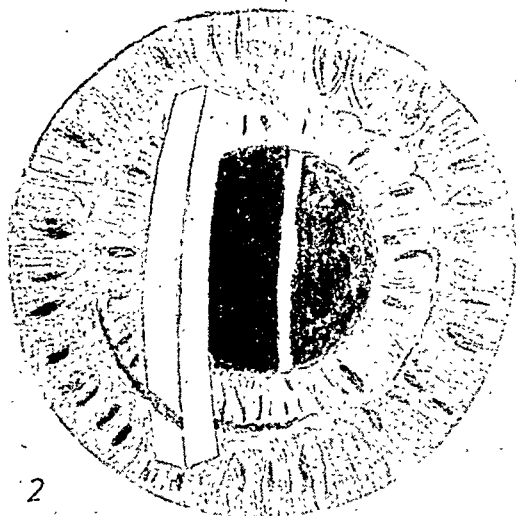
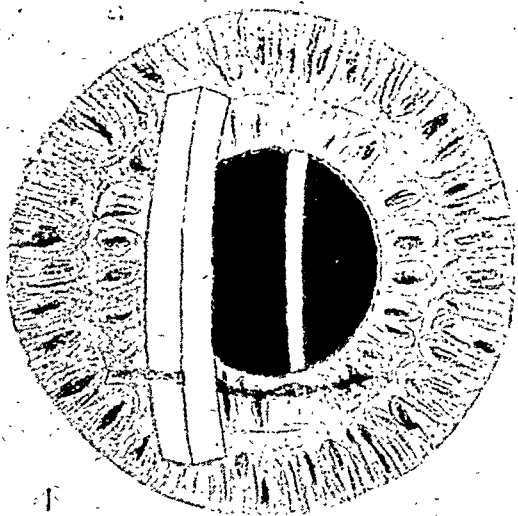
meters of normal cornea. The superior borders of these pigmented areas were almost horizontal, and the crescents occupied the portion from the lower third to the lowest sixth of the corneas. Individual pigment clusters were contained within the epithelium to a very slight extent and to a far greater one within Bowman's membrane. The surface of the involved cornea was entirely regular. Pillat³ has described pigmented areas so placed and shaped as to resemble the

pigmented crescents herein depicted. He considered these to be melanomata.

The oblique lines have all been identical with Stähli-Hudson lines except that they ran in a vertically oblique direction.

Amorphous pigment deposit is a term used here to describe a group of pigment clusters without discrete boundaries and occurring in the Bowman zone.

In these types of superficial pigmentation the color of the pigment varied from light yellow through green to dark brown.



Figs. 1, 2, 3, 4 (Blondis). Semidiagrammatic drawings of pigmented corneas. Fig. 1, Stähli-Hudson line intercepted by slitlamp beam. Fig. 2, Fleischer ring intercepted by slitlamp beam. Fig. 3, oblique line intercepted by slitlamp beam. Fig. 4, crescent intercepted by slitlamp beam.

All shades were seen, varying with the severity of the pathologic process, its duration, and the individual complexion. In all cases, all other factors remaining the same, in the Negro and the dark-complexioned races the pigmentation was of darker hue and more bountiful. Whenever there was a concomitant pigmentation of the skin the corneal pigmentation (if present) was in direct ratio. Except in the cases of amorphous deposits the reaction was reversible and the pigmentation disappeared when the eye had completely returned to its normal state.

In this study superficial pigmentation of the cornea was found in five types of corneal pathologic change. There can be little doubt that these do not exhaust the conditions wherein it can occur.

Four hundred and fifty-three (453) individuals whose eyes had been burned with the vapor or liquid of mustard gas (dichloroethylsulfide) have been examined. These cases revealed pigmentation of the superficial cornea in 127, or 28 percent. In other chemical burns of the eyes the corneas were not routinely searched for pigment. Therefore such cases are not utilized for statistical purposes in this paper.

Of approximately 3,600 other individuals whose eyes were examined, search for pigmentation of the superficial layers of the cornea revealed it in 71 cases, or 2 percent.

CASE REPORTS

The following reports are typical of the cases in which the pigmentation described was observed.

Case 1. A white man, aged 62 years, was subjected to the explosion of a mustard shell while unmasked. His left eye was severely burned and his right only slightly. After 12 days, examination of the cornea of the right eye with a

microscope showed a typical Stähli-Hudson line. This was colorless; three days later it was ochre-yellow; one week later it was greenish-brown. Three weeks after the injury the line had completely disappeared, and there was no sign of the injury the eye had suffered. The left eye at no time showed corneal pigmentation. Despite the severity of the burn of this eye no vascularization of the cornea developed and no iris changes or keratic precipitates were seen. The pathologic change was essentially an infiltration of the cornea below Bowman's membrane which resulted in a "snow-flake" stroma.

Case 2. A white man, aged 26 years, was subjected to the same explosion and suffered a severe burn of the left eye and a mild one of the right. The findings were the same as in case 1 except that the pigmented line ran in a vertically oblique direction in several widespread areas of the exposed portion of the cornea of the mildly injured eye. The severely injured eye followed the same pattern as the severely injured eye described in case 1.

Case 3. A Negress, aged 32 years, worked, unmasked, in the immediate vicinity of a mustard-gas spill. Her right eye was moderately burned and her left severely. Eight days after the injury an incomplete Fleischer ring was visible in the cornea of the right eye. This remained for three months. All other signs and symptoms resulting from the injury disappeared about two weeks earlier. For the first three months following the injury to her severely burned eye there was no evidence of corneal pigmentation. After this time she developed pannus degenerativus of this cornea and with it appeared an influx of brown pigment as far as the vertex of that membrane. This coloration was amorphous, patchy, and followed the approximate course of the invading blood vessel. At this date (six

months after the injury) the vascularization and the pigmentation are still present.

Case 4. A Negro, aged 42 years, was exposed on two successive days to the vapor of mustard gas. On the third day he developed a typical keratoconjunctivitis⁴ of both eyes. Two days later, as the signs and symptoms receded, there was noted an area of greenish-brown pigment, crescent shaped, occupying the lower third of the cornea. Examination with the microscope revealed pigment following slightly irregular lines, densely packed, separated from the limbus by an unpigmented zone about 2 mm. wide. The pigment was limited to Bowman's membrane. About eight days after the injury, although the signs and symptoms had almost disappeared, the upper border of the pigmented crescent had become demarcated into a distinct line resembling a Stähli-Hudson line but continuous with the crescent-shaped area of pigment below it. Seven weeks after the injury and six weeks after all other signs and symptoms had disappeared there was no sign of corneal pigmentation.

Case 5. A Negress, aged 37 years, suffered a burn of the cornea of the left eye from white phosphorus. This resulted in an indolent ulcer at the site of the injury. About three weeks after the burn, the injury had been converted into an epithelized, nonstaining, depressed facet, and at this time its base became infiltrated with a yellowish-brown color. This pigmentation was limited to the burned area in Bowman's zone and increased in intensity for one week after it first appeared. Eight weeks later the depressed facet had been filled in from below and was nebulous. At this time the pigmentation was sufficiently diminished in amount to make it barely visible with the microscope.

Case 6. A man, Mexican-born, aged 28 years, had bilateral vascularized pterygia that encroached on his corneas for approximately 4 mm. He was unaware of their presence. Both corneas showed typical Stähli-Hudson lines.

Case 7. A white child, aged 6 years, was first seen with a solitary phlyctenule of the cornea of the left eye. There was no pigmentation of the superficial cornea. About two weeks later there were multiple phlyctenules and encroaching vascular fasciculi. At this time one of the therapeutic agents used was a 0.1-percent solution of epinephrine hydrochloride.⁵ Five weeks after the onset of the disease the entire cornea was traversed by superficial blood vessels. At this time there first appeared a colorless dehiscence corresponding to a Stähli-Hudson line in location and form. Within two days this line was colored greenish-brown. The vascularization of the cornea and the pigmented line are still present although it is approximately four months after the onset of the illness.

Case 8. A white man, aged 28 years, was first seen with severe, acute iridocyclitis, hyphema, hypopyon, and secondary glaucoma of the right eye. The cause of the inflammation was undetermined. He was treated with the usual local medication and typhoid vaccine intravenously. Two weeks after his illness started the intraocular pressure was within normal limits, there was no blood nor other cells in the anterior chamber and all signs of inflammation were minimal. At this time a typical Stähli-Hudson line was first seen. It was ochre-yellow in color and remained visible with the microscope for five weeks. All other signs of the inflammation had disappeared one week before this except two minute posterior iris synechiae.

DISCUSSION

Most frequently, this corneal discoloration occurred in eyes which were burned with mustard-gas liquid or vapor. It was a frequent finding and disappeared during the stage of healing, which may be prolonged many months if the injury has been caused by the liquid.⁶

It has been a common observation that long contact with the vapor of this vesicant, even though insufficient to cause injury, has resulted in progressive pigmentation of the exposed skin; but it has not been observed in either the conjunctiva or the cornea. This pigmentation is considered to be a response to chemical irritation, a phenomenon long ago observed.⁷

It is interesting to note that when the corneal burn from mustard gas has been severe this pigmentation has not been observed except when the injury to the cornea resulted in vascularization of that membrane. Redslob⁸ found that when the achromogenic cornea is vascularized it develops the potentialities necessary for the elaboration of pigment. When the injury to the cornea penetrated beneath Bowman's membrane no pigmentation of the cornea was observed. When the corneal injury had been deep enough to cause inflammation of the iris with keratitic precipitates these became pigmented quickly.

Pigmentation of the superficial cornea in cases of abrasion in the absence of a foreign body occurred in this series. Here the pigment lay within Bowman's zone in the area of injury and occurred only during the stage of healing. Infection did not need to be present to induce this phenomenon. Staining with 1-percent cresyl-blue solution revealed that these corneas had dilated lymph spaces. The mechanism here was probably the same as that in chemical injury of the cornea. Here too

the injury causing a pigment response did not extend beneath Bowman's membrane.

As has already been pointed out, yellowish-brown pigmentation of the superficial layers of the cornea in keratitis eczematosa⁹ has been observed during this study. The pigment appeared shortly after the vascularization of the cornea, was superficial (within Bowman's zone), yellow to brown in color, and disappeared with the disease. In this condition the pigment existed as Stähli-Hudson lines and also within the maculas resulting from ulcerated phlyctenules to which vascular fasciculi had extended. It is noteworthy that one such case was treated with a solution containing 0.1-percent epinephrine hydrochloride over a period of several months (case 7). Loewenstein⁵ reported that the long-continued use of adrenalin as drops can give rise to pigmented nodules on the conjunctiva. Further, he produced this experimentally.

The nature of the pigment occurring in the cornea has been the subject of some speculation but of little investigation. The likelihood that this pigment is melanin is supported by the similarity between the crescents of pigment herein described and the accumulations of pigment reported by Pillat and by him considered to be melanomata. In addition, some of the pigment seems to be identical in appearance with that described by Meesmann¹⁰ within the cells of the corneal epithelium in Addison's disease. Further, the greater amount of pigmentation in the superficial cornea in Negroes than in whites with the same or similar pathologic conditions speaks in favor of melanin.

To this fact, should be added the relationship of the corneal pigmentation to that occurring in the skin. In mustard-gas keratitis, there occur several of the types of superficial pigmentation of the cornea herein described and not infrequently a

pigmentation of the skin that is clinically indistinguishable from melanosis. When it is recalled that the conjunctiva is but a modified skin and the corneal epithelium merely an especially adapted epithelial layer of that membrane, this concomitance takes on special significance. No report in the literature has shown the presence of melanin or its precursors in the urine of individuals suffering from such exposure. We have attempted to find such pigment in the urine and have been unsuccessful.

Duke-Elder¹¹ describes the migration of chromatophores from the stroma of the uvea into the ciliary muscle and the inner layers of the sclera, whence they sometimes travel along the perivascular channels to appear subconjunctivally and within the loose episcleral tissue associated with vessels and nerves. The close relationship between the conjunctiva and the corneal epithelium has already been mentioned.

Redslob⁸ found that some of the deeper cells of the conjunctiva covering the caruncle were potential melanoblasts which became deeply pigmented on oxidation, and further demonstrated the presence of potential melanoblasts in the region of the limbus. In addition, it is known that the caruncle is frequently pigmented during Addison's disease. Therefore, it seems quite likely that the limbus forms a barrier to the passage of the melanin from the conjunctiva to the corneal epithelium despite the close relationship between them. These melanoblasts within the deeper layers of the limbus contain a colorless substance that is converted into melanin in the presence of the oxidizing ferment dioxyphenylalanine (dopa). The barrier at the limbus may be physiologic, physical, or chemical, and during the pathologic process may be neutralized to permit the migration of

these cells into the corneal epithelium. There may well be a chemotaxis that stimulates migration of cells along the corneal lymph channels, which have been demonstrated with intravital staining to be widely dilated following chemical irritation of that membrane.

Some investigators have stated that the pigment is derived from the blood, and, indeed, Moncrieff¹ has shown in one reported case that it was hemosiderin. There is little evidence to support this idea in the cases here reported. However, the actual demonstration of hemosiderin by Moncrieff within the cornea must be accepted as more accurate than mere observation. According to her conception the blood pigment diffuses down from the upper limbus through the intercellular spaces of the corneal epithelium.

Stähli¹² postulated that the pigment was derived from the alkali-hematin present in the tear fluid and the pooling of that fluid in the inferior cul-de-sac caused the imbibition of the pigment into the corneal epithelium. There is no absolute evidence to support this hypothesis.

All investigators are in agreement concerning the development of the Stähli-Hudson line. There occurs a tension of Bowman's membrane that is most marked at the meeting point of the upper and lower lids during the winking reflex. This results in either a degeneration or tear in that membrane along that line, and is intensified by the mechanical action of the lids. The dehiscence thus formed is demonstrable with the slitlamp and corneal microscope, when using a 1-percent solution of cresyl-blue stain in normal eyes of some middle-aged and elderly individuals. It is this dehiscence that is responsible for the colorless type of Stähli-Hudson line described by Vogt. If the pigment described is melanin it is deposited here through the migration of

melanoblasts along the intracorneal lymphatics. At this line it is assumed that the colorless pigment-bearing cells are converted into colored, pigment-bearing cells and become temporarily fixed. It is more difficult to comprehend that the diffusion of hemosiderin to this line is possible in the absence of any trace of its path, although Moncrieff found that histologically actual pigmentation was much more extensive than that seen clinically.

The formation of the Fleischer rings is similar. The lesion lies in Bowman's membrane and the pigment therein occurs in the same manner as in the Stähli-Hudson line. The only difference is in the location of the original stress or trauma to Bowman's membrane and this depends on the area of maximum injury to the cornea.

The oblique lines within the cornea that occur also in Bowman's zone are undoubtedly produced in like manner and their position and direction are results of trauma in varying areas and directions.

The explanation for the formation of the crescent of pigment seems to agree with the hypothesis of Stähli who considered the pigment to be an iron derivative from the alkali-hematin of the tears. Certainly the pooling of the tears in the inferior cul-de-sac could produce such a formation of pigment, provided that the pigment could be imbibed by the corneal epithelium. This does not explain why the greatest amount of the pigment is in Bowman's zone and not within the epithelial cells themselves. It seems more likely that this area is merely a dense arrangement of lines produced in the manner suggested above and that the pigmentation occurs in a like manner.

SUMMARY AND CONCLUSIONS

1. Pigmented lines in the superficial

layers of the cornea are not rare in our experience. They were seen in 28 percent of 453 individuals whose eyes were burned with mustard gas and in 2 percent of 3,600 other cases in such conditions as white-phosphorus burns, pterygia, eczematous keratitis, and iridocyclitis.

2. Eight case reports are presented which represent the abnormalities in which this pigmentation has been observed and the various morphologic characteristics of the pigment.

3. Stähli-Hudson lines, Fleischer rings, oblique lines, and pigmented crescents are the result of pigmentation of dehiscences in Bowman's membrane and represent merely the same type of injury in different locations within this membrane.

4. Observation of the cases reported here favors the concept that this pigment is melanin, although histologic and chemical studies in a single case demonstrated that the pigment in that case was hemosiderin. Conclusive evidence of the character of the pigment is not yet available.

5. If a corneal burn extends deeper than Bowman's membrane, no pigmentation occurs unless the superficial cornea becomes vascularized.

6. In the presence of the abnormalities already described, the melanin content of the conjunctiva at the limbus is increased, but this pigment does not invade the cornea unless damage has been done to that membrane. This suggests that a barrier to the cornea exists at the limbus which is destroyed when that membrane is injured.

7. Most observers agree that the pigment reaches the superficial layers of the limbus and the most likely pathways are the lymph spaces in the cornea, which can be demonstrated under certain conditions to be widely dilated.

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GLIOMA OF THE OPTIC NERVE*

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In a review of the whole literature in 1912, Hudson¹ mentions not more than 182 cases of glioma of the optic nerve. Katzin² recently reported a case of glioma of the optic nerve with discussion of the occurrence, symptomatology, course, and pathology, and pointed out that this lesion had been described not more than 300 times in the literature up to the present. This rare occurrence seems to be reason enough to add another case of such a neoplasm that has just come under observation.

CASE REPORT

E. F., a colored girl aged eight years, came to my office on March 3, 1945. Her father stated that the right eye had been swollen for six weeks, the swelling gradually increasing. There had never been any inflammation of the eye; nor was there a

history of an injury. The child had not complained of pain at any time. No convulsions or other signs had been noticed. An optician or optometrist had provided her with glasses one month ago.

The child had never been seriously ill.

The general aspect of the patient was good. She was well nourished and seemed to be healthy. Her answers revealed normal mental qualities.

Both eyes were white, without irritation. There was marked proptosis of the right eye, with some restriction of the movements to the extreme right and left. Tension was good in both eyes.

Right eye: There was a definitely increased resistance to backward pressure of the eyeball. No masses could be felt around the globe. The pupil was fixed to light, dilated, and reacted well consensually. Vision was nil.

The lower portion of the disc was swollen, covered with a mass of inter-

*From the Ophthalmological Service of Dr. R. K. Lambert, The Mount Sinai Hospital.

twining small and large blood vessels, partly newly formed. This mass extended out into the vitreous to a height of about 6D. As did also the adjacent lower part of the retina, which was grayish and showed dilated and tortuous vessels. There was no detachment of the retina.

The *left eye* was normal in all respects, vision being 20/20 with a +2.5D. cyl. ax. 90° lens.

The tentative diagnosis was: Tumor of the optic nerve.

On the basis of diagnosis the patient was referred to the Mount Sinai Hospital,

which was approximately twice the size of the left (fig. 1). There were no demonstrable abnormalities of the orbit or sella turcica. X-ray studies of the abdomen and of the long bones revealed no evidence of metastases. An electroencephalogram was normal.

The differential diagnosis between neoplasm of the orbit and tumor of the optic nerve was not difficult, for the main symptoms suggesting the latter were present; namely, nonpulsating, slowly progressive proptosis straight forward, light limitations of movements, early visual failure,



Fig. 1. (Mannheimer). Roentgenogram of the skull showing the enlargement of the right optic foramen.

where the ocular findings were completed by exophthalmometry. The readings were: R.E. 22, L.E. 16 at 98 mm. The width of the papebral fissure was: right, 10 mm.; left, 7 mm.

The field of the left eye showed a slight limitation medially and in the lower field.

Transillumination could not be effected because of poor coöperation.

The general medical examination revealed no pathologic findings. Wassermann reaction was negative. There were no signs of tuberculosis. An X-ray study of the skull showed a considerable enlargement of the right optic foramen,

papilledema, and, perhaps as the most important symptom, enlargement of the optic canal.

Since the intracranial part of the optic nerve was unquestionably involved, Dr. Ira Cohen was consulted, who suggested intracranial section of the nerve prior to enucleation. He proceeded as advised by performing a craniotomy on March 30th.

Operation. On the right side, a Frazier type bone flap was turned down. Before opening the dura through a nick in it, a brain needle was passed into the anterior horn of the right lateral ventricle. This allowed the escape of an estimated 10 c.c.

of spinal fluid. The dura was then opened by an incision just above the bone margin along the temporal and frontal portions. The frontal lobe was elevated. The olfactory nerve was identified and freed from this attachment. Further retraction exposed the right optic nerve. For a little over one half of its distance from the

anteriorly, the flap was replaced, the anterior inferior burr hole was filled with a mixture of bone dust and bone wax, and the scalp was replaced and sutured with two layers of silk.

The child stood the operation very well. Nevertheless, a transfusion was given, beginning at about the middle of the operation.

The postoperative course was uneventful.

The microscopic picture of the resected nerve was described by Dr. Globus as follows:

Section stained with hematoxylin and eosin shows the tissue to be for the most part broken up into small lobules or compartments, but with fairly well-developed connective-tissue trabeculae. Within each of these compartments, there are many cells recognizable mainly by the incorporated nuclei. The latter are variable in size and outline, the majority, however, being oval and fairly rich in chromatin. The nuclei are supported by a syncytium of cytoplasm material which in places is highly vacuolated and in other parts indicates the reticular nature of the cells. In all probability these cells are glial in character. In some compartments the nuclei are much denser than in others, and in some are exceedingly few. Diagnosis: Glioma of the optic nerve (Schwannoma).

On May 1st a second operation on the child took place. Dr. Lambert performed an enucleation with extirpation of the optic nerve. Its isolation from the surrounding tissues within the narrow orbit was tedious. However, working along the nerve in a proximal direction, he was able to resect the entire nerve. It was cystlike, thickened, the diameter of the most enlarged site being approximately 15 mm. The tumor was entirely confined to the optic nerve, with no spreading to the orbital tissues (fig. 3).

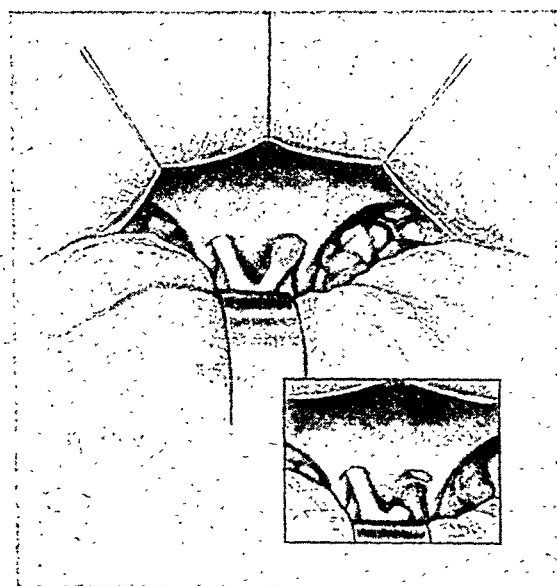


Fig. 2. (Mannheimer). Operative field sketch showing the tumor of the right optic nerve before and after resection.

optic foramen and the chiasm, it was very much swollen, probably three to four times the normal diameter. It was also somewhat knobby (see figure 2, drawn during the operation by Alfred Feinberg).

With the trigeminal sharp hook, the nerve was divided close to the chiasm. Then, with the cutting loop, it was removed in two sections, flush with the optic foramen. There was a little troublesome bleeding from the cut in the nerve, which was coagulated. It is judged that not more than 1 mm. of the nerve was left proximate to the chiasm, and this appeared normal.

Bleeding having been completely controlled, the dura was tightly closed, a Penrose drain was let out from the extradural space through a stab wound pos-

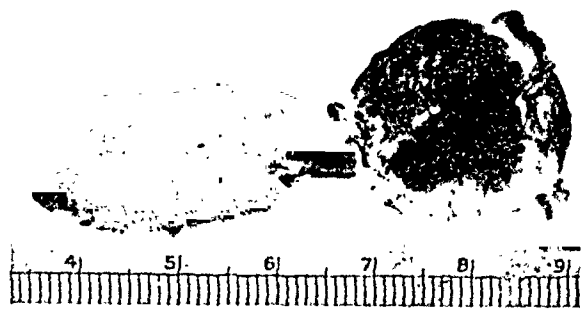


Fig. 3. (Mannheimer). Enucleated globe with resected optic nerve.

The postoperative course of the second operation was uneventful. The child is at present (six weeks later) in good general health. Her left eye is normal, especially the fundus, and she has the same vision as when seen first.

The prognosis of this case is favorable. As gliomas do not metastasize and do not perforate the sheaths of the nerve, it may be assumed that the child will remain well. The decisive factor is the involvement of the chiasm, but an operation is not feasible. With further infiltration of the chiasm there will follow blindness of the other eye, sooner or later, and from pressure on the centers of the diencephalon serious disturbances of the vegetative system will ensue and finally death. Whether X-ray therapy can be of lasting benefit, is doubtful. Duke-Elder goes so far as to call roentgen therapy "of little significant value." On the other hand it is well known that gliomas of the optic nerve have a slow growth; von Hippel³ mentions a patient under his observation, who was absolutely well after an incomplete extirpation 20 years previously.

DISCUSSION

The case herein presented, so far as symptomatology, therapy, and pathology are concerned, is to be regarded as rather typical. With reference to the differential diagnosis it has been pointed out that all symptoms of an optic-nerve growth were

present. They are similar to those of an orbital tumor, the three classical symptoms of which were established by von Graefe⁴ as early as in 1864; namely, proptosis, disturbance of the motility of the globe, and visual deterioration. The displacement of the globe in tumors of the nerve is usually directly forward or approximately so, showing slow progress. The motility of the globe is less impaired than might be expected from the proptosis. This is different in tumors of the sheaths, when the orbital muscles and nerves become infiltrated; then ocular movements become considerably restricted.

The visual acuity usually deteriorates early and rapidly. For this reason diplopia by displacement of the globe does not occur, contrary to what occurs in the case of orbital tumors, where this symptom is very common.

The tendency of the growth of the tumor is directed back toward the brain; it may, as Duke-Elder puts it, "cause a hypermetropic refraction by pressure upon the posterior pole of the eye. More commonly the effects of obstruction of the circulation are seen—papilledema, and eventually secondary atrophy are relatively common." In my case there was both a hyperopia of 6D. and a partial papilledema. There was no atrophy of the disc; this agrees with the fact that in most cases the degree of visual defect is out of all proportion to the ophthalmoscopic signs. One of the most important changes caused by the proximal growth of the tumor—namely, the enlargement of the optic foramen—was present. Thus, an involvement of the intracranial part of the nerve by the neoplasm was out of the question. As symptoms of extension into the chiasm and into the brain were absent, the therapeutic procedure was a first operation—resection of the intracranial part.

of the affected nerve—and a second operation—the extirpation of the intra-orbital portion. The ophthalmoscopic findings were such as led to the assumption that the posterior pole of the globe was involved or at least its immediate vicinity, so that the eyeball had to be sacrificed. Since this was not the case a resection of the orbital part of the nerve could have been performed by means of the Kroenlein operation, with preservation of the globe, done for the first time in a case of optic-nerve tumor by Braunschweig⁵ in 1893, or by opening the orbit from the conjunctiva with temporary tenotomy of the recti internus and superior.

The anatomic nature of tumors of the optic nerve remained controversial for a long time with much confusion as to the terminology. Since the classical papers of Hudson in 1912 and of Verhoeff⁶ in 1922 the anatomic picture has been clarified. These investigators pointed out that "the essential feature in the production of these tumors is an overgrowth of glial tissue" and that "gliomas are the only primary intraneural tumors of the optic nerve that have been observed." They differ from each other only quantitatively, depending on the presence of various glial elements in different proportions and arrangements. These true gliomas are related to those occurring in the brain and, this should particularly be stressed, have no relation to the common malignant tumors of the retina popularly called "glioma."

As has been mentioned, all optic-nerve tumors, whether they originate from the nerve proper or from its sheaths, are rare, the gliomas being the most common. Reviewing large series of treated patients, Collins and Marshall, as also Verhoeff, came to a ratio of tumors of about 1:176,000 (Davis⁷). With regard to the age of the patients, most gliomas were found in

children under five years of age. Tumors of the nerve sheaths—endotheliomas of Hudson—occur later, most of them after the age of 30. Most observers agree that the female is more frequently affected; Lundberg,⁸ however, could not find this difference in his cases.

The vast majority of the gliomas arise from the intraorbital portion of the optic nerve. Their growth is fairly characteristic. It is almost invariably slow, although temporary periods of rapid growth have been reported. They advance by direct extension along the intraneural portion of the nerve and, as has been mentioned do not penetrate the sheaths, so that as a rule a diffuse and uniform hypertrophic swelling, sometimes of a spindle-shaped appearance, is produced.

The glial tumor starts with an abnormal proliferation of the normal adult type of neuroglia (Davis). The neoplastic tissue permeates the intraseptal spaces, with occasional invasion of the septa. They usually are enormously thickened, made up of collagenous fibers. This collagenous hyperplasia is regarded as reactive in nature and secondary to the gliomatous process in the nerve. This is particularly obvious when a glioma occurs in general neurofibromatosis or von Recklinghausen's disease. By the growth of the glial tissue the nerve fibers are spread apart, stretched, and compressed, so that they become demyelinated at an early stage, which means loss of vision. The intermingling of secondarily proliferated mesothelial cells of the arachnoid with the neuroglia cells produces a complex histologic structure, the precise nature of which is difficult to interpret. The neoplastic glial cells are uni- or bipolar spongioblasts in type, are long and spindle-shaped with oval nuclei and processes at each end. From an embryologic point of view it will be understood that

these cells are identical with the characteristic cells of this type of tumor that is found in the brain.

SUMMARY

A somewhat typical case of glioma of the optic nerve has been presented with

discussion of the diagnosis, operative treatment, and biopsy. The favorable prognosis has been stressed after extirpation of the neoplasm *in toto*. Two operations at different times proved to be the therapy of choice.

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THE RELATIONSHIP BETWEEN LIGHT ADAPTATION AND DARK ADAPTATION AND ITS SIGNIFICANCE FOR APPRAISAL OF THE GLARE EFFECT OF DIFFERENT ILLUMINANTS*

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A precise knowledge of the characteristics of adaptation of the eye to light is of importance for several reasons other than that such a fundamental process should be as clearly understood as possible. It will be demonstrated in this communication that serious errors will result in the determination of dark adaptation if account is not taken of the initial adaptation to light. Accurate determinations and the understanding of the effects of glare are not possible without a knowledge of the adaptation to light.

Data on light and dark adaptation on 10 individuals will be presented. Particu-

lar emphasis has been placed on the relationship between the rates of light and dark adaptation, the relationship between the dark-adaptation time and the initial light-adaptation threshold, the relationship between brightness and length of exposure to the rate of light and dark adaptation, both daily and interindividual variation, and the effect of spectral distribution.

In contrast to the great number of publications on dark adaptation which have been published during recent years, the problem of light adaptation studied by determination of brightness thresholds has attracted considerably less attention. Several publications have presented data on the influence of brightness level on light adaptation,¹⁻⁴ but we know of only one paper⁵ wherein the speed of light adapta-

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tion has been investigated by varying the duration of light exposure at a constant brightness. However, the time intervals used were too long to determine details of the course of light adaptation, especially in the early phases. These data have established that, in general, light and dark adaptation follow opposite trends. With increasing exposure time or higher brightness, light adaptation proceeds faster and dark adaptation more slowly. For this reason, light and dark adaptation might be looked upon as corresponding catabolic and anabolic processes expressed in terms of concentration of photosensitive material, as is the case in Hecht's formula.⁴ While there is no doubt of the opposite trends of light and dark adaptation, their mutual relationship has not yet been thoroughly studied. Some discrepancies between light adaptation and dark adaptation are apparent in the material of Hecht *et al.*¹ and of Müller⁵ as well as in our own investigations on the light penetration through the eyelids.⁶

METHOD

Due to the numerous variations of time intervals and brightnesses in our experiments, resulting in up to 40 exposures in one single testing series, Blanchard's³ method for determining the instantaneous thresholds after light exposure was not applicable. Instead, we used an approximate method, measuring the threshold about five seconds after the light exposure in successive experiments with increasing light-exposure duration; this we define as the relative light-adaptation threshold. Thus, we obtained a curve of threshold values somewhat below the instantaneous threshold but closely related to it. Variation of ± 1 second in the time of the first reading produced only minor differences of the relative light-adaptation threshold, hardly exceeding the experimental error (± 5 percent).

After the first reading, which is an index of light adaptation, the progressive dark adaptation was measured until the value of 0.05 millifoot candles (M.F.C.) was reached. This value includes full cone adaptation and the first (rapid) segment of rod adaptation after longer exposure times or higher brightness. After short exposure time, the dark adaptation is so rapid that cone and rod adaptation are not clearly separated.

Newton's instrument was used, in which the brightness of the test patch (of one-third degree, five degrees above the small red fixation point), is changed by varying the angle of a light beam illuminating the test patch. Thus, the color of the test patch does not change at different brightness levels. In order to investigate the effect of spectral distribution, ordinary frosted incandescent lamps (A) were compared with a new illuminant (B) with reduced radiation at both ends of the visual spectrum. More detailed information about the spectral distribution of this illuminant (Verd-A-Ray) is given in former papers.^{7, 8} On each experimental day, both the illuminants—A (ordinary frosted lamps) and B (Verd-A-Ray lamps)—were compared at the same brightness level. For light exposure, the subject viewed, from a distance of six inches for lamp A, a frosted glass plate placed in front of a box and illuminated from behind by a centrally fixed lamp. The different levels of illumination were obtained by using different bulbs (25, 60, 100, and 200 watts), corresponding to 125, 200, 620, and 1,050 F.C. at the level of the observer's eye. Since the brightness of illuminant B was about 25 percent lower in our arrangement, equal brightness for both illuminants was obtained by shortening the distance to the frosted glass plate for illuminant B. Since the visual field was already very large at the distance of

six inches from the frosted glass plate (used for lamp A), its enlargement at the closer distance from lamp B is of no consequence. For the brightness levels of 125, 200, and 620 F.C. the following exposure times were used: 0.5, 1, 2, 5, 10, 20, 30, 40, 50, 60, 70, 80, 90, and 100 seconds. The series of consecutive exposures was terminated as soon as the limit of the instrument (10 M.F.C.) was reached. Sometimes in order to determine the time necessary to reach 10 M.F.C. more accurately, intermediate exposure times were given. Nevertheless, the light adaptation time for 10 M.F.C. cannot be determined with the same accuracy as the thresholds below this upper limit. For the brightness level of 1,050 F.C. much shorter exposure times were used (0.5, 1, 2, 3, and so on seconds).

Three well-trained and seven less-well-trained subjects were used, the latter only for the 200-F.C. brightness level. These subjects represented the extremes of fast and of slow dark-adaptation times in a former series of 32 subjects.⁷

The readings were repeated for all or most exposure times. All light exposures were given as soon as the subject had reached the threshold value of 0.05 M.F.C. The relative light-adaptation thresholds agreed in most duplicate readings within 5 percent of the mean. If the discrepancy was greater the same exposure was repeated for a third time. The dark-adaptation-time readings (time to reach the threshold of 0.05 M.F.C.) agreed within ± 10 percent, greater discrepancies being due to interference of afterimages.

In the three trained subjects the same arrangement was repeated on four to six different days with a reversed order of lamp A and B. In the seven less-well-trained subjects the experiments were repeated on two different days.

RESULTS

Course of light adaptation and of dark adaptation. Table 1 shows the average results of relative light-adaptation thresholds for exposure durations between

TABLE 1
LIGHT ADAPTATION (M.F.C.) AVERAGE VALUES

Subject	F.C.	Lamp	Exposure Duration (seconds)								
			0.5	1	2	5	10	20	30	40	50
S.S.	125	A	4.3	4.8	5.1	5.4	6.3	7.3	8.0	8.6	9.1
		B	4.1	4.4	4.7	5.2	5.6	6.1	6.9	8.0	8.7
	200	A	5.4	6.2	6.4	6.8	7.4	8.7	9.4	10	
		B	5.4	6.0	6.4	6.7	7.4	8.1	9.0	9.6	
	620	A	5.2	6.1	7.1	7.8	8.8	10.0			
		B	5.5	6.0	7.0	7.3	8.4	9.4			
	1050	A	7.2	8.4	9.5						
		B	7.5	8.4	9.1						
E.S.	125	A	4.6	5.1	5.7	5.9	5.9	6.8	7.5	8.1	9.0
		B	4.1	4.6	5.3	5.6	5.8	6.3	6.8	7.2	8.3
	200	A	4.4	5.4	6.4	6.8	7.6	8.2	9.9	9.5	
		B	4.2	5.0	5.8	6.3	6.6	6.8	7.6	8.4	
	620	A	5.4	6.8	7.6	8.3	8.7	9.4	10		
		B	5.1	6.6	7.7	8.2	8.4	8.9	9.7		
	1050	A	7.2	8.8	9.5	10					
		B	7.9	8.4	8.9	9.6					
S.B.	125	A	6.4	7.1	7.8	8.5	9.4	10			
		B	6.2	6.9	7.9	8.5	8.9	9.5			
	200	A	8.3	9.5	10.0						
		B	8.0	8.8	9.2						
7 subjects	200	A		4.2	5.1	6.0	6.7	7.7	9.0	—	
		B		3.9	4.8	5.6	6.2	7.1	7.5	—	

TABLE 2

DARK-ADAPTATION TIME (SECONDS, AVERAGE VALUES) TO REACH 0.05 M.F.C.

Subject	F.C.	Lamp	Exposure Duration (seconds)								
			0.5	1	2	5	10	20	30	40	50
S.S.	125	A	14	13	20	25	32	47	64	86	93
		B	13	14	17	24	29	34	39	58	75
	200	A	14	17	24	30	37	45	58	67	
		B	15	24	25	32	42	46	63	67	
	620	A	13	15	22	27	38	64			
		B	13	18	22	27	35	55			
	1050	A	21	26	41	45					
		B	17	23	33	35					
E.S.	125	A	20	23	30	33	46	61	85	112	128
		B	17	21	24	29	32	49	59	73	93
	200	A	23	30	41	48	60	83	115	145	174
		B	23	30	40	46	50	61	73	94	124
	620	A	31	39	48	53	78	108	144		
		B	28	32	45	51	64	96	110		
	1050	A	36	49	66	102					
		B	39	48	63	85					
S.B.	125	A	24	30	37	44	50				
		B	20	27	33	34	39				
	200	A	40	46							
		B	33	43							
7 subjects	200	A	—	25	31	39	45	57	77	—	
		B	—	25	35	37	40	47	62	—	

0.5 and 50 seconds, for the purpose of general orientation as to the magnitude of changes. The longer exposure times at the 125- and 200-F.C. brightness levels

are omitted. The figures are averages of 4 to 6 experiments in subjects S. S., E. S., and S. B., and averages of 14 experiments on 7 subjects in the last two lines. It will be noted that the wide threshold range from 0.05 to 4 or more M.F.C. is passed through within less than 0.5 second, while the further increase is much slower. Table 2 shows the corresponding average values of the duration of dark adaptation necessary to reach the level of 0.05 M.F.C.

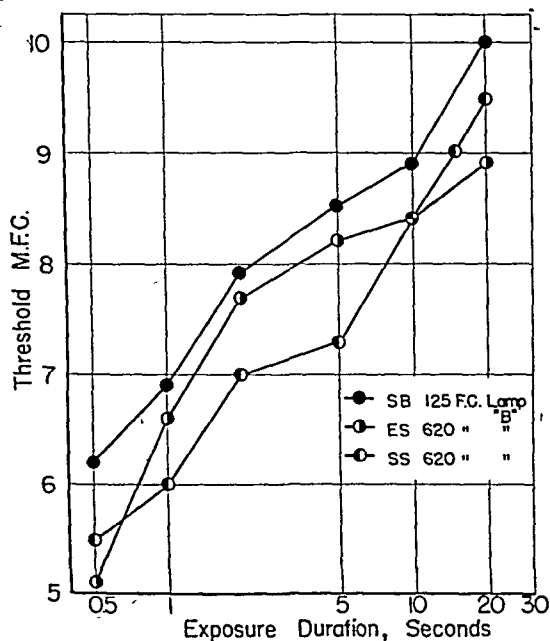


Fig. 1 (Simonson, Blankstein, and Carey). Average light-adaptation curves in three well-trained subjects.

The average curves of light adaptation in most instances show a sigmoid shape, except at the highest brightness of 1,050 F.C., where the speed is too rapid for our intervals of exposure durations. Figure 1 shows the average light-adaptation curves for 620 F.C. with subjects E. S. and S. S., and 125 F. C. for subject S. B., because his speed is of approximately the same order at this lower brightness level. The curves were obtained with lamp B; however, there were no differences between lamps A and B in this

respect. For a duration of exposure between 2 and 5 or 10 seconds the light-adaptation speed is slower than before or after. The shape of the curves is, of course, largely determined by the logarithmic abscissa of the exposure time, but the sigmoid contour is also present with linear coordinates. Figure 2 shows a sigmoid contour also in the corresponding dark-adaptation time, due to a less-pronounced

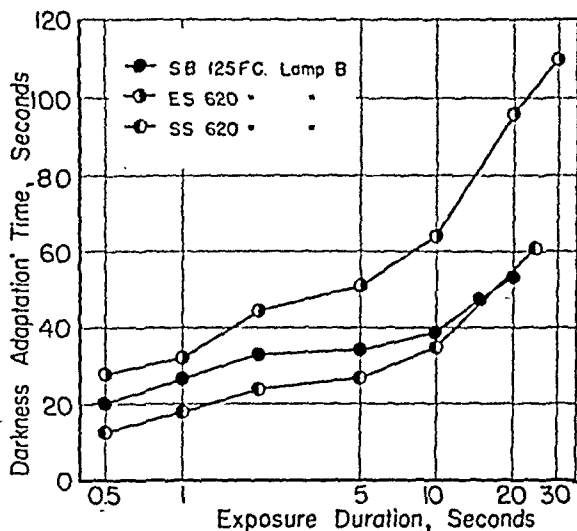


Fig. 2 (Simonson, Blankstein, and Carey). Average dark-adaptation curves for three well-trained subjects.

increase of dark-adaptation time when the duration of exposure was between 2 and 5 seconds.

The comparison between tables 1 and 2 and of figures 1 and 2 shows a general relationship between light and dark adaptation, in that with increasing exposure time and brightness the relative light-adaptation threshold increases, whereas the dark-adaptation speed decreases. Furthermore, with lamp B light adaptation is slower, whereas dark adaptation is faster at the longer exposure times.

This apparently good agreement does not hold, however, for the details of the course of light and dark adaptation. In the single experimental series we found frequently that in two or more consecutive

exposures of increasing durations the thresholds of light adaptation or the dark-adaptation time remained the same. Irregular increase of the threshold with increasing duration of exposure was present in almost all experiments, as is also revealed in the sigmoid contour of the average curves.

The frequency of plateaus was greatest at the lower illumination levels of 125 and 200 F.C. (in 12 out of 20 experiments with subjects S. S. and in 12 out of 15 experiments with E. S.). In subject S. S., the plateaus (mostly of only two consecutive exposure durations) occurred between 1 and 5, rarely 10, seconds' exposure time, corresponding to threshold values between 5.5 and 7.0 M.F.C. In subject E. S., the plateaus were, in general, of longer duration, up to four consecutive exposure times, corresponding to threshold values from 5.2 to 7.2 M.F.C. Rarely were plateaus observed at higher threshold values or longer exposure times. At 620 F.C. and 1,050 F.C. brightness, S. S. showed no plateaus, whereas there were plateaus of somewhat shorter duration in 6 out of 12 experiments with subject E. S., at thresholds between 8 and 9 M.F.C. No plateau was observed at 1,050 F.C. The plateaus occurred with both illuminants, A and B. Subject S. B., who had a much faster light-adaptation speed, showed no plateaus. The seven less-well-trained observers also showed no plateaus. Plateaus were observed for the total dark-adaptation time for two or more consecutive exposures and were even more frequent than those of the light adaptation; they were present in several experiments with S. B. and also in the seven less-well-trained subjects. Sometimes the plateaus of light and dark adaptation coincided in time, but often they did not.

In Müller's series there was a steady increase of the relative light-adaptation

TABLE 3

COURSE OF LIGHT AND OF DARK ADAPTATION IN SINGLE EXPERIMENTS

Subject	Date	F.C.	Lamp	Light Adaptation (M.F.C.) Exposure Duration (Sec.)								Dark Adaptation (Sec.) Exposure Duration							
				20	30	40	50	60	70	80	90	20	30	40	50	60	70	80	90
S.S.	3/2	125	B	6.8	7.7	8.2	8.8	9.2	9.8	10		30	31	50	90	85	88	85	
	4/13	125	A	7.0	7.5	8.4	8.8	9.0	9.6	10		33	33	60	95	95	90	93	
	5/21	200	B	7.0	8.3	8.9	9.6	10.0				47	47	50	45	45			
Dy.	6/22	200	B	5.2	8.0	8.7	8.9	9.6	10			11	15	16	19	18	17		
E.S.	3/30	125	A	6.0	6.4	6.8	8.0	8.6	8.8	9.5	10	45	75	105	110	120	145	180	225
	4/5	200	B	6.0	7.2	8.2	8.4	9.2	10			60	70	100	105	140	215		

threshold (first readings) up to 40 minutes, even sloping up from 20 to 40 minutes' exposure, while the dark-adaptation time to reach 3 different threshold values (0.42, 0.047, and 0.005 Millilux) remained practically constant from 10 to 40 minutes' exposure time. A similar discrepancy was found in several experiments with S. S. (table 3), but was most pronounced in subject Dy, who had the fastest adaptation time. In subject E. S., the opposite tendency of excessive increase of dark-adaptation time at the higher threshold values was frequently observed: two typical experiments are shown in table 3. Table 4 shows a plateau of dark adaptation with increasing light adaptation in subject S. S. at shorter exposure times than those in table 3, and the opposite phenomenon (plateau of light adaptation, steady increase of dark-adaptation time), in subject E. S. Sometimes the plateau of dark-adaptation time and light threshold begins simultaneously, but terminates earlier in either one (table 4).

and exposure duration on light and dark adaptation. From the average curves of light and dark adaptation the light-adaptation time (seconds) necessary to reach 5, 6, 7, 8, 9, and 10 M.F.C., and the corresponding dark adaptation time (seconds) necessary to recover the level of 0.05 M.F.C. were determined by graphic interpolation. The results for the four brightness levels and lamps A and B are shown in table 5, the left side representing speed of light adaptation, the right side representing the corresponding speed of dark adaptation.

The increase of the speed of light adaptation with brightness is obvious. However, the recovery time (cone dark adaptation, right side of table 5) for a given threshold is not uniform, but depends on the conditions of exposure duration or brightness under which the given threshold has been obtained. In general the recovery time for a given threshold increases with exposure duration and consequently decreases with brightness, although a few minor exceptions are noted. Since increasing brightness at constant exposure time would prolong the

Comparison of the effect of brightness

TABLE 4

DISCREPANCIES IN THE COURSE OF LIGHT AND OF DARK ADAPTATION

Subject	Date	F.C.	Lamp	Light Adaptation M.F.C. Exposure Duration					Dark Adaptation (sec.) Exposure Duration				
				2	5	10	20	30	2	5	10	20	30
E.S.	3/20	125	B	6.4	7.2	7.2	7.2	7.8	30	32	38	45	45
S.S.	4/27	200	A	5.5	6.5	7.0	8.5	9.0	28	35	35	35	56
E.S.	4/5	200	B	6.0	6.0	6.0	6.0	7.2	40	40	40	60	70
	3/30	125	A	5.2	5.2	5.2	6.0	6.4	25	25	35	45	65

TABLE 5

SPEED OF LIGHT ADAPTATION TO REACH THRESHOLD VALUES BETWEEN 5 AND 10 M.F.C. FROM 0.05 M.F.C., AND OF DARK ADAPTATION TO RECOVER THE INITIAL THRESHOLD OF 0.05 M.F.C.

Sub- ject	Thresh- old M.F.C.	Light Adaptation (seconds)								Dark Adaptation (seconds)							
		125 F.C.		200 F.C.		620 F.C.		1050 F.C.		125 F.C.		200 F.C.		20 F.C.		1050 F.C.	
		Lamp A	B	Lamp A	B	Lamp A	B	Lamp A	B	Lamp A	B	Lamp A	B	Lamp A	B	Lamp A	B
S.S.	5	1.5	3.4							16	19						
	6	6.8	19	0.85	1.0	0.9	1.0			21	33	18	23.5	15	18		
	7	16.5	31.5	6.2	6.8	1.9	2.0			30	43	32	33.5	21	22		
	8	30	40	14.5	20	4.9	6.4	0.83	0.75	47	58	42	46	27	29.7	24	20
	9	49.5	60.5	24	30	11.3	15	1.55	1.95	81	83	51.7	62.5	43	45	36	33
	10	78	90	40	50	20	28	3	5	95	90	67	71	64	62	48	38
E.S.	5	0.9	1.5	0.8	0.9					24	23	28	29				
	6	10.5	13.8	1.5	3.0	0.68	0.75			45	41	34	41	35	33		
	7	22.0	35.0	5.8	22	1.2	1.3			66	66	50	64	40	39		
	8	38	48	16	35	3.1	3.0	0.7	0.6	106	88	75	84	52	47	42	41
	9	50	66	30	49	13.1	20.5	1.25	2.7	128	116	115	120	90	97	55	68
	10	75	95	47.5	65	29	37	4.5	9.5	185	162	207	180	147	123	100	102
S.B.	6	.34	.39							19	18						
	7	.93	1.03							29	27						
	8	2.5	2.3	0.44	0.5					38.5	33	37	33				
	9	6.8	10.5	0.75	1.5					47	38	43	46				
	10	14.7	20.0	2.0	3.2					61	51.5	55	53				

dark-adaptation time, it is obvious that the effect of increased brightness is over-compensated by the shortening of exposure duration. The duration of exposure appears to be a more important factor in regard to dark-adaptation time than the brightness level of light exposure.

In order to evaluate, in regard to light adaptation, the relative importance of exposure duration versus brightness, the product of duration and brightness (F.C.-seconds) was calculated for the various

combinations of exposures and brightness levels. These values were compared at the following F.C.-seconds: 200, 620, 1,240, 3,000, 6,200, and 10,000. Table 6 shows the exposure time for each brightness level necessary to attain the same value of F.C.-seconds. For this comparison, values with lamp A at 10 F.C. were available from another study⁶ up to the value of 3,000 F.C.-seconds. At the higher values of 6,200 and 10,000 F.C.-seconds lamp B was used for comparison because of the

TABLE 6

RELATIVE LIGHT-ADAPTATION THRESHOLDS AT EQUAL F.C.-SECONDS EXPOSURE

Sub- ject	Lamp	Sec.	10 F.C.		125 F.C.		200 F.C.		620 F.C.		1050 F.C.	
			F.C.	Th.	F.C.	Th.	F.C.	Th.	F.C.	Th.	F.C.	Th.
			Sec.	M.F.C.	Sec.	M.F.C.	Sec.	M.F.C.	Sec.	M.F.C.	Sec.	M.F.C.
S.S.	A	20	200	5.5	1.6*	200	5.0	1	200	6.20	—	—
E.S.				3.56	*		5.4			4.35		
S.B.				8.65			7.5			9.50		
S.S.	A	60	600	7.48	5	625	5.4	3*	600	6.5	1	620
E.S.				5.68			5.9			6.5		
S.B.				10			8.5			10		
S.S.	A	120	1200	8.52	10	1250	6.25	6*	1200	6.9	2	1240
E.S.				6.8			5.9			6.95		
S.S.	A	300	3000	9.92	24*	3000	7.6	15*	3000	8.	5*	3100
E.S.				8.16			7.1			7.9		
S.S.	B	—	—	—	50	6250	8.65	30	6000	9.0	10*	6200
E.S.							8.3			7.7		
S.S.	B	—	—	—	80	10000	9.8	50	10000	9.9	16*	9920
E.S.							9.5			9.05		

* Interpolated values.

slower light adaption; with lamp A no value at 10,000 F.C.-seconds was available. Most threshold values in table 6 are direct readings, which are preferable even if there are minor differences in the F.C.-seconds values obtained. In a few cases (marked with *), the threshold values were interpolated. The threshold values are in general higher at both ends; that is, at the longest exposure time with lowest illumination level and at the shortest ex-

Interindividual discrepancies between light- and dark-adaptation speed. Table 7 shows the light- and dark-adaptation speed of seven subjects, calculated for thresholds from 4 to 10 M.F.C. The values are averages of two determinations made on different days. At 10 M.F.C. threshold, the light-adaptation time for lamp A varies between 30 to 50 seconds, and for lamp B between 35 to 70 seconds. The dark-adaptation speed for the same

TABLE 7

LIGHT- AND DARK-ADAPTATION SPEEDS (SECONDS) AT DEFINITE THRESHOLD VALUES (M.F.C.), OBTAINED IN SEVEN UNTRAINED SUBJECTS WITH 200 F.C. BRIGHTNESS (AVERAGE OF 2 EXPERIMENTS)

M.F.C.:	4 Lamp		5 Lamp		6 Lamp		7 Lamp		8 Lamp		9 Lamp		10 Lamp		
Sub- jects	A	B	A	B	A	B	A	B	A	B	A	B	A	B	
Dy	1.9	2.5	5.2	9.5	18	21	25.5	26	31	30	40	43	50	70	Light
Cu	1.2	1.2	2	2	4	4.8	6	12	14	22	25	31	35	45	Adapt.
Wi	—	—	—	—	1.6	1.6	3	3	9	10	17.5	20	30	35	"
Sch	—	1.5	3	4.9	6	12	14	18	20	27	28	35	40	50	"
Ba	0.8	1.2	2	3	4.5	4.0	15	20	25	35	33.9	42.5	40	55	"
Be	2.5	5	7.5	19	17.5	24	23.5	31.5	28.5	38.5	34	42	41	51	"
Du	—	—	—	—	1.5	1.5	5	7	18	19	30	31	40	40	"
Dy	15.8	12.2	15.0	12.5	17.0	12.0	19.5	13.5	21	15.5	22.5	16.5	22.5	18	Dark
Cu	25.5	21	26	27	27	27	29	28.5	39.5	32	56	42	77.5	61	Adapt.
Wi	—	—	—	—	41	48	51	56	66	67	81	85	122	132	"
Sch	—	12.5	13.5	13	15	22	27	26	36	51	50	56	50	72.5	"
Ba	48	80	72.5	83	100	85	122	115	135	170	190	216	253	235	"
Be	14.5	20	19.5	22	26.3	27.5	28.3	38.5	29	38.5	39	41	50	46.5	"
Du	—	—	—	—	28	28	30	23	44	40	45	40	67	51	"

posure time with the highest brightness level. The only exception is in subject E. S. who had steadily increasing thresholds with brightness at the smallest F.C.-seconds values of 200 and 620. The minimum threshold has the tendency to appear at higher brightness levels with increasing F.C.-seconds values including the values of E. S. The results of table 6 indicate that in regard to light adaptation, the length of exposure has a greater effect in raising the threshold at low levels of illumination; whereas at the higher levels of illumination, brightness is the more important factor. In general, the threshold is higher at the highest brightness level than at the longest duration of exposure. In this respect, light adaptation and dark adaptation are different.

threshold varies between 22.5 and 253 seconds for lamp A and between 18 and 235 seconds for lamp B. The seven subjects were selected as manifesting the extremes of slow and of fast dark-adaptation times in a series of 32 subjects,⁷ in order to investigate whether the same subjects show also extreme differences in light-adaptation speed. This is obviously not the case. Table 5 shows similar discrepancies between the three well-trained subjects. The light-adaptation speed of S. S. and E. S. is approximately the same, that of S. B. very much faster. The dark-adaptation speed is fastest in S. B. and slowest in E. S.

In regard to the total dark-adaptation time for equal exposure duration, the values of S. B. are closer to those of E. S.

than to those of S. S. (table 2), since the faster dark-adaptation speed compensates for the faster light-adaptation speed in this subject. This illustrates that measurement alone of dark-adaptation time after standardized exposure cannot reveal the true individual dark-adaptation speed.

The correlation coefficients between light and dark adaptation were calculated

ing dark-adaptation time is compared at two brightness levels for each subject. Only direct readings are given in table 8, so that the threshold values differ slightly, but are still equal within the experimental error. It can be seen that the daily variations of light and of dark adaptation do not coincide. There is a tendency to longer dark adaptation with slower light

TABLE 8
DAILY VARIATIONS OF LIGHT AND OF DARK ADAPTATION

Subj.	F.C. Lamp	1944 Date	Light- M.F.C.	Adapt. Time	Dark Adapt. Time	F.C. Lamp	1944 Date	Light- M.F.C.	Adapt. Time	Dark Adapt. Time
S.S.	200 B	3/10	8.4	30	83	620 B	2/8	8.0	15	45
		3/13	8.2	20	35		3/24	8.0	10	35
		4/27	8.4	20	50		4/5	8.2	5	34
		5/8	8.1	30	37		5/2	8.1	2	17
		5/18	8.2	10	47		5/23	8.3	10	23
		5/21	8.3	30	47					
E.S.	620 A	1/27	9.0	20	110	1050 A	3/24	9.0	1	45
		2/1	9.0	10	100		4/11	9.2	2	70
		3/10	8.8	10	70		4/13	9.0	2	60
		3/13	8.8	5	55		5/8	8.8	0.05	30
		5/18	9.0	10	60					
		5/21	9.0	20	90					
S.B.	125 B	2/9	8.4	10	36	200 A	2/2	8.7	2	55
		2/11	8.3	5	35		2/4	9.0	1	45
		2/23	8.4	2	35		5/3	9.0	1	42
		4/3	8.6	2	25		5/5	9.0	1	42
		4/15	8.5	5	32					
		5/9	8.5	5	42					

for the 10 subjects at the thresholds of 6 and 9 M.F.C. and 200 F.C. brightness. It was expected that a slower light adaptation would correspond to a faster dark adaptation. The coefficients were $+0.22$ and $+0.2$ for lamp A and $+0.37$ and -0.1 for lamp B. There is no significant correlation between individual light- and individual dark-adaptation speed.

Discrepancies of daily variations of light and dark adaptation. Table 8 shows a few examples of daily variations of light and of dark adaptation in the three well-trained subjects. For each experiment the time to reach a certain threshold value during light exposure and the correspond-

adaptation. This tendency is consistent with our results (table 5) that a longer exposure duration at the same threshold level tends to prolong dark-adaptation time. However, this tendency alone cannot explain the discrepancies in the daily variations of light and dark adaptations in table 8. Discrepancies in the daily variations between light and dark adaptations occurred also in the experiments with the seven less-well-trained subjects.

The effect of spectral distribution on light and dark adaptation. Table 1 shows that the threshold values are lower with lamp B than with lamp A at the higher thresholds, whether they are obtained

with longer exposure times at lower brightness or with shorter exposure times at higher brightness. This is consistent with our former results⁷ of faster dark adaptation with illuminant B after much longer exposure times of two minutes. The superiority of lamp B, however, is not so evident at the shorter exposure times. Obviously, only the secondary slower part of light adaption is clearly influenced by the effect of spectral distribution, while the effect on the initial fast process is doubtful. In the average results from seven subjects light adaptation is slower throughout the whole range of exposure times with lamp B. However, the difference between lamp A and lamp B increases with exposure duration.

In regard to the corresponding duration of dark adaptation (table 2), there is a marked tendency to faster dark adaptation with lamp B at the longer exposure times, the only exception being in subject S. S. at 200 F.C. At the short exposure times of 0.5 and 1 second, most differences between lamp B and lamp A are within the experimental error.

Table 5 may be used to decide whether the faster dark-adaptation time with lamp B can be explained as a consequence of the slower light adaptation with this illuminant, or whether an additional effect on dark adaptation is present. It is plain that a faster light adaptation will produce a longer dark-adaptation *time* even if the actual dark-adaptation *speed* is the same.

Since in table 5 the dark-adaptation time is compared for the same threshold values, the actual dark-adaptation speed is obtained, and the influence of different light-adaptation speed is eliminated. It seems that different individual and brightness trends occur in lamp B and lamp A. The effect of lamp B on light adaptation appears to be more consistent than the effect on dark adaptation.

All seven less-well-trained subjects except Du' had a slower light-adaptation speed with lamp B, either throughout the whole range or at least at the higher M.F.C. thresholds. The effect of lamp B on dark-adaptation speed differed in different subjects. It is interesting to note that individual differences existed in regard to the effect of spectral distribution on light- and on dark-adaptation speed.

COMMENT

Although light-adaptation threshold and corresponding dark-adaptation time increase with brightness and with exposure duration, our results reveal numerous discrepancies between light adaptation and dark adaptation. The increase of dark-adaptation time with increasing exposure duration is not always parallel to the increase of the relative light-adaptation threshold in the same experimental series. Daily variations of light and dark adaptation do not coincide, and there is a lack of correlation between individual dark- and light-adaptation speed. The discrepancy in the daily variations is not surprising, since Hecht¹ observed that the daily variations of the cone and of the rod segment of the dark-adaptation curve may not coincide.

The occurrence of plateaus or of an irregular slope in the increase of relative light-adaptation thresholds and of dark-adaptation time with increasing light-exposure time is probably only an expression of quantitative differences of the same phenomenon. An increase of less than 5 percent of the threshold value in the subsequent exposure duration would still fall into the limit of experimental error. However, the sharp break during the first 0.5 second is best explained with the transition from α to β adaptation.⁹ Schouten and Ornstein⁹ assume that there are at least two different processes of light

adaptation with different parameters. Although a basic photochemical process during light adaptation is certainly present, the pure photochemical relationship between light and dark adaptation is interfered with by several unknown factors. This bears out Hecht's¹ prediction that further suppositions are necessary to describe some visual data. Our results concern cone light and dark adaptation only, and no direct transfer on rod adaptation should be made. However, the whole range of rod adaptation is passed through very rapidly during light exposure even at somewhat dim illumination levels, so that the change of brightness sensitivity occurs in the range of the cones after exposure times as short as 1 second. This does not exclude, of course, that the rod threshold increases simultaneously, although overshadowed by the changes of cone sensitivity. However, it cannot be expected that the relationship between rod dark adaptation and cone light adaptation will be closer than that between cone light and cone dark adaptation.

In a previous paper,⁶ the light penetration through the eyelid was different when calculated for light and dark adaptations, so that we assumed that light adaptation and dark adaptation might be different not only in direction but also in nature. The present results support this conclusion. Dark-adaptation time for a given light threshold increases with the exposure duration necessary to reach this threshold. This is consistent with the observations of Elsberg and Spotnitz¹⁰ on recovery of visibility from glare. Obviously, dark adaptation is involved in this process. Our results confirm Schouten and Ornstein's⁹ finding that different rates of recovery can exist for any sensitivity level and may be regarded as additional evidence for the view¹¹ that a given light threshold cannot be regarded as an equiv-

alent for the concentration of photosensitive material. While increasing exposure duration is a more important factor than increasing brightness for the dark-adaptation time, the effect on light adaptation is different.

There are two practical applications of our results: one is concerned with the technique of dark-adaptation measurements, the other with the appraisal of the glare effect. It can be concluded that the currently used method to standardize conditions for dark-adaptation measurements is not adequate. Usually a standardized light-exposure duration of from one to several minutes is given, after which dark-adaptation time is measured. Due to the lack of correlation between light and dark adaptation speeds, the initial threshold from which dark adaptation starts is different in different subjects. There is some possibility that individual differences will be somewhat levelled at longer exposure durations, but this assumption is neither safe nor supported by the trend of our curves. The present method of measuring dark adaptation is roughly comparable to an attempt to study the oxygen debt after muscular exercise without knowing the work load. There are two ways of measuring the actual dark-adaptation speed: (1) to vary the brightness so that light adaptation speed is comparable; or (2) to vary exposure duration at constant brightness so that the same threshold of light adaptation is attained.

To our knowledge, light and dark adaptations have not yet been used for a comparative study of the glare effect of different illuminants, although both are such fundamental visual processes that they should not be neglected in the appraisal of glare effects. The differences of light and dark adaptation obtained from two different illuminants, A and B, are encouraging for the use of this method. Our

previous results⁷ with dark adaptation alone have been confirmed in this series. The dark-adaptation time is shorter after exposure to lamp B, owing to the changed spectral distribution of this illuminant. In addition, the present series allows a differentiation between the effect on light and on dark adaptation. This is desirable because of the lack of correlation between both processes. Four different combinations of glare effects are possible, which are illustrated by the following scheme, comparing two hypothetical illuminants or conditions x and y.

were used in our previous series, the concordant effect will be still more manifest.

The effect on light adaptation appears to be more important since it concerns the primary response that is responsible for the immediate state of visual sensitivity during light exposure, and also determines to a large extent the recovery time. It may be mentioned that light adaptation can be measured also by indirect methods such as fusion frequency of flicker,¹² brightness-difference thresholds,¹³ or visibility.¹⁴ Since different visual processes

<i>Light Adapt. Speed</i>	<i>Dark Adapt. Speed</i>	<i>Effect</i>
(a) $x = y$	x faster y slower	Same glare effect during exposure; faster dark-adaptation time in x
(b) x faster y slower	$x = y$	Greater glare effect in x during exposure; dark-adaptation time longer in x as a consequence of the faster light adaptation (higher threshold)
(c) x faster y slower	x slower y faster	Concordant: Greater glare effect in x during exposure; dark-adaptation time much longer in x as added effect of faster light-adaptation and slower dark-adaptation speed
(d) x faster y slower	x faster y slower	Discordant: greater glare effect in x is compensated in regard to the dark-adaptation time by the fast dark-adaptation speed

We have evidence for the existence of any one of the combinations (a) to (d) in our experimental material.

Using this scheme for analysis between lamp A and B for a rather wide range of relative light-adaptation thresholds, combination (b) is valid up to 9 M.F.C. This means that the diminished glare effect of lamp B is due to a slower light-adaptation speed without change of dark-adaptation speed. At the longest exposure duration, near 10-M.F.C. threshold, an additional effect on dark adaptation becomes apparent leading to combination (c). This tendency is rather obvious, although not yet quite uniform. Probably, at still longer exposure times, such as

are used as criterion for light adaptation in the indirect methods, no mutual transfer of results is possible.

SUMMARY

1. The effect of brightness levels (between 125 and 1,050 F.C.) and of exposure duration (varied between 0.5 and 100 seconds) on light and on dark cone adaptation was investigated in three well-trained and seven less-well-trained subjects, comparing usual frosted lamps (A) with an illuminant (Verd-A-Ray, lamp B) with reduced radiation at both ends of the visual spectrum.

2. Although dark-adaptation time increases with increasing light-adaptation

threshold, whether due to increasing brightness or exposure duration, there appears to be no consistent relationship between light-adaptation speed and dark-adaptation speed.

3. The dark-adaptation time for a given light-adaptation threshold tends to increase with increasing exposure duration.

4. For the speed of light adaptation the exposure duration appears to be of greater importance than the brightness only at low levels of brightness, whereas with higher illumination the brightness is more important.

5. The increase of the threshold during light adaptation and the increase of dark-adaptation time often do not run parallel.

6. In 10 subjects, no relationship be-

tween individual speed of light and of dark adaptation was noted.

7. Daily variations of light and of dark adaptation do not coincide.

8. The shorter dark-adaptation time of illuminant B, found in previous series, is confirmed. It is, at threshold values up to 9 M.F.C., a result of a slower light adaptation; at longer exposure times and higher threshold values there is an increasing tendency to an additional effect on dark adaptation. This is interpreted as increased tolerance of glare and faster recovery after glare with this illuminant.

9. Implications regarding a standard procedure for exact determination of dark-adaptation speed and analysis of glare effects have been discussed.

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THE CONTROL OF EXPERIMENTAL ANTERIOR-CHAMBER INFECTIONS WITH SYSTEMIC PENICILLIN THERAPY*

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The efficacy of penicillin in the treatment of ocular infections has been extensively studied in animal experimentation as well as by clinical application. Infections of the bulbar and palpebral conjunctivae, ulcerations of the cornea and corneal injuries accompanied by perforation¹⁻⁶ have been successfully treated by local application of penicillin. Gonorrheal ophthalmia in adults^{7,8} has been promptly cured by intramuscular injection of penicillin. The successful response of orbital cellulitis and cavernous-sinus thrombosis^{1,3,5,9,10} to penicillin, parenterally administered, has been reported. One of us (A. E. T.) has treated two patients with severe orbital cellulitis by the systemic administration of penicillin. Clinical improvement was rapid and recovery was uneventful. Scant attention has been given to consideration of the clinical efficacy of this agent in intraocular infections.⁶ Von Sallmann¹¹ found the administration of penicillin by corneal bath and by iontophoresis to be effective in checking experimentally produced pneumococcal infection of the anterior chamber, even when delayed for 12 to 13 hours after inoculation. Treatments were given once or twice daily over a period of two to four days. When there was an associated lens injury, it was found that, to be effective, therapy

must be started earlier and continued over an extended period of time.

In a previous communication, one of us¹² has reported on the concentration of penicillin in the anterior chamber of the rabbit eye following intravenous and intramuscular injection of the drug. The present paper concerns itself with the application of these findings in a study of the effect of intramuscularly administered penicillin in experimental streptococcal infection of the anterior chamber.

EXPERIMENTAL TECHNIQUE

The organism chosen for production of intraocular infection was a penicillin-sensitive strain of nonhemolytic streptococcus. Virulence of the organism had been increased by use of a culture medium containing 5-per cent mucin and by animal passage. The inoculum was a 24-hour culture in brain-heart infusion broth, diluted to one part in 10 or one part in 100 depending on the severity of the initial infection desired.

Rabbits were chosen as the experimental animal. With a fine hypodermic needle, 0.1 ml. of the diluted culture was injected through the upper quadrant of the cornea near the limbus into the anterior chamber. Within 7 to 12 hours a localized area of keratitis could be recognized which progressed rapidly to a generalized keratitis in the untreated animals. A conjunctivitis of varying severity usually manifested itself at the same time.

Penicillin therapy was initiated for each animal at such time as a definite keratitis could be recognized. The dose was approximately 5,000 units per kilo-

* From the U. S. Naval Hospital and Naval Medical Research Institute, National Naval Medical Center, Bethesda, Maryland. A thesis presented to the American Ophthalmological Society, in partial fulfillment of the requirement for membership. The opinions and views set forth in this article are those of the writers and are not to be considered as reflecting the policies of the Navy Department.

gram of body weight, given intramuscularly every three hours.

EXPERIMENTAL FINDINGS

Control animals. Adequate control animals were included in the study to show that the untreated eye, infected by the technique described always went on to extensive generalized keratitis with resultant extensive scarring or complete opacity of the cornea; to an involvement of other parts of the eye; or, in some instances, to a panophthalmia.

Preliminary experiments. A series of preliminary experiments showed the limitations of penicillin to control ocular infection. Their value lies in contrasting the methods used with those in later experiments which were successful. In some of the very early studies, a fulminating infection, recognizable in three or four hours and rapidly progressive, was obtained following the use of excessively heavy inoculum. This difficulty was obviated by further standardization of the virulence of the organism to allow the adoption of a uniform dilution of the culture for successive experiments.

Since it had been previously found that a marked increase in the concentration of penicillin in the aqueous humor of noninfected eyes following paracentesis,¹² one group of animals was treated by intramuscular injection every three hours combined with drainage of the anterior chamber twice daily. By the second day of treatment it became apparent that, in the presence of an infection, the ill effects resulting from puncture of the cornea and withdrawal of aqueous humor, with the consequent disturbance of normal equilibrium within the anterior chamber, was not counterbalanced by the higher concentration of antibacterial agent obtained by this procedure. With continued treatment, the in-

fection became progressively worse and resulted in panophthalmia at the end of three days. Cultures taken on the fifth day were still positive for streptococcus.

In one group of animals, the infection was allowed to progress to a severe keratitis, involving the entire cornea, with massive purulent exudate in the anterior chamber, before treatment was started. Under penicillin therapy the keratitis did not progress further, but so much damage to the cornea had taken place that, from a clinical point of view, the results were discouraging. However, samples of the aqueous humor removed 48 hours after an eight-day course of therapy, were found to be bacteria free. Thus it was shown that anterior-chamber infections may be controlled and eventually eradicated by persistent treatment with penicillin, even when they are so severe and have persisted so long as to cause irreparable damage to the cornea.

Critical experiment. With the aforementioned limitations in mind, a critical experiment was set up with 13 animals. Beginning infection could be recognized in all animals seven hours after injection of the standardized inoculum of streptococcus into the anterior chamber. At that time, one infection was of sufficient severity for initiation of therapy following withdrawal of aqueous for culture. Penicillin injections were started in nine other animals during the next five hours, at such time as a definite keratitis became apparent. It was continued by intramuscular injection of 15,000 units (approximately 5,000 units per kilogram of body weight) every three hours for eight days. The remaining three animals were considered to have insufficient infection for inclusion in the study. It is interesting to note that eight days later one of these was found with pitting cicatrices of the cornea and severe iritis.

TABLE 1

BACTERIOLOGIC FINDINGS ON AQUEOUS HUMOR FROM TEN RABBITS WITH EXPERIMENTAL ANTERIOR-CHAMBER INFECTIONS TREATED WITH PENICILLIN INTRAMUSCULARLY

Rabbit No.	9978	9992	9998	9988	9990	9000	9984	9983	9979	9976
Prior to treatment	Pos.	Pos.	Pos.						Pos.*	
Day of treatment										
2	Pos.	Pos.	Pos.				Pos.		Pos.	
4	Pos.*	Pos.	Pos.						Neg.	
5							Pos.			
6	Neg.	Pos.*	Pos.	Neg.	Pos.*	Pos.*	Neg.	Neg.	Neg.	Neg.
8		Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.		

* Negative after 24 hours, positive after 48 hours incubation.

The bacteriologic findings on samples of aqueous humor withdrawn during the course of therapy are shown in table 1. Due to the previously mentioned altered character of secondary aqueous humor, samples were taken on only 4 of the 10 animals prior to therapy. Cultures were repeated on these four animals on the second day of therapy and, at that time, a fifth animal was added to this group which was to be subjected to frequent bacteriologic study. Samples were not taken from the eyes of the remaining five animals until the infection appeared, from clinical observation, to be under control. Cultures on all 10 treated animals were negative by the eighth day, at which time therapy was discontinued.

The tabulated clinical findings (table 2)

show that, with one exception, the conjunctivitis had disappeared by the fifth day of treatment. Keratitis responded more slowly, but had cleared by the eighth day. There was recurrence in only one animal, brought about, in all probability, by trauma to which the eye was accidentally subjected on the ninth day after initiation of therapy. Hypopyon was present in seven of the infected eyes, appearing with or subsequent to the keratitis. In seven instances an exudate, purulent in nature, occurred in the pupillary area. It was absorbed slowly, assuming a veil-like membranous form, apparently attached to the margin of the iris, before disappearing. In one eye the exudate did not appear until the eleventh day and was thin and membranous when first observed.

TABLE 2

CLINICAL FINDINGS ON TEN RABBITS WITH EXPERIMENTAL ANTERIOR-CHAMBER INFECTIONS TREATED WITH PENICILLIN INTRAMUSCULARLY

Rabbit number	9978	9992	9998	9988	9990	9000	9984	9983	9979	9976
Day of treatment on which finding was observed										
Conjunctivitis subsided	5	5	8*	4	4	4	4	5	4	5
Keratitis subsided	6	11†	8	8	6	7	8	4	5	7
Hypopyon observed	None	None	6	3	2	1	1	None	1	1
Hypopyon absorbed			11	8	5	11	7		5	4
Exudate in pupillary area	None	7	3	6	5	None	6	5	11‡	1
Exudate absorbed		16	16	13	8		12	16	16	8
Area of opacity (18th day)	Minute (3)	Small	None	Small	Small	None	Small	None	Minute (3)	Minute

* Conjunctivitis subsided fourth day but recurred on sixth. No recurrence after eighth day.

† Keratitis receded on the eighth day but flared up after accidental trauma on the ninth day, subsiding without recurrence on the eleventh day.

‡ Thin membranous exudate.

Daily examination of the eyes was continued until the eighteenth day, at which time two presented a normal appearance, without evidence of damage. In five instances there was present a small opacity of the cornea in the upper quadrant near the limbus. Two other eyes showed three minute areas of opacity in the same region. The consistent occurrence of opacities at the site where needle punctures were made as well as the fact that multiple areas of opacity were present only in those eyes from which aqueous had been successively withdrawn, points to the fact that they occurred as a result of penetration of the infecting organism into the cellular layers of the cornea along the needle track. In rabbit number 9998 no opacities of the cornea were present on the eighteenth day, but an opacity of the lens was apparent. This eye had responded slowly to treatment, and clouding of the aqueous was observed from the eleventh to the eighteenth day. Apart from damage to the lens, probably resulting from an injury by the needle at one of the punctures, this eye appeared normal.

DISCUSSION

Results obtained in the treatment of infections of the anterior chamber by intramuscular injection of penicillin were in accord with what were to be expected from previous findings in regard to its concentration in the aqueous humor.¹² Because levels of therapeutic activity differ for various infecting organisms, it was suggested that a high dosage level would be required for adequate control of intraocular infection. Actual experimentation showed that a considerably lower dosage was adequate for the streptococcal infection studied.

Injection through the cornea into the anterior chamber of a minute quantity of

an organism which had been standardized at highest virulence by animal passage and the use of mucin broth, resulted in an infection which could be duplicated at will. This technique is a modification of that used by Picot¹³ and, later, by Von Sallmann.¹¹ It entails the use of local anesthesia only and is in contrast to the method used by Robson and Scott² in their work on corneal ulcers. They employed general anesthesia and injected the organisms under the corneal epithelium to produce a bleb in the cornea.

It would appear from accumulated evidence that conjunctivitis, corneal ulcers, and dacryocystitis respond favorably to local treatment with penicillin drops or ointment. In cases of perforating corneal ulcers, perforating injuries to the cornea accompanied by infection, and intraocular infections, the use of this type of local-penicillin therapy has met with considerable disappointment. In 1941, Abraham and his co-workers¹ reported a case of corneal ulcer that showed little improvement after treatment with penicillin drops. When corneal baths were substituted the response was prompt. Von Sallmann¹¹ used the corneal bath as well as iontophoresis, with success in infections of the anterior chamber. He found that this procedure did not result in demonstrable amounts of penicillin in the vitreous humor.¹⁴ In a recent article, Dunnington and Von Sallmann⁶ report success in arresting experimental infection of the deeper portion of the lens and of the vitreous by injection of penicillin directly into the affected part. Such treatment usually failed when an interval of 24 hours was allowed to elapse between the inoculation and therapy. In most instances no permanent damage resulted from the injection of penicillin solution, although a temporary opacity occurred. In the absence of infection, penicillin was injected

into the anterior chamber. This procedure resulted in a moderately inflammatory reaction which persisted for 24 to 72 hours.

These latter findings taken in conjunction with our own experiences that, in the presence of infection, the repeated withdrawal of aqueous was followed by extension of the infection and opacities at site of needle puncture, suggest the need for extreme caution in the use of a therapeutic method which entails puncture of an intact cornea in the presence of an infection. This in no way invalidates the previous observation¹² that an infection accompanying a perforating injury to the eyeball may be expected to respond more readily to systemic penicillin therapy than one in which there is no escape of intra-ocular fluid.

Since the efficacy of local penicillin therapy has been well explored by other

workers, only systemic administration of the antibacterial agent was employed in the experiments reported here. Local application of the drug combined with an intensive regimen of systemic therapy offers promise to the clinician confronted with a serious ocular infection, provided the infecting organism is penicillin-sensitive.

SUMMARY

1. Experimental infections of the anterior chamber of the rabbit eye which could be duplicated at will, were induced.

2. These experimental infections were controlled and, in the absence of lens injury, normal function of the eye was regained following intramuscular administration of penicillin.

3. Massive doses of the drug over an extended period of time were required for successful therapy.

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SOCIETY PROCEEDINGS

EDITED BY DONALD J. LYLE

MEMPHIS SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

February 13, 1945

HYDROPS OF THE CORNEA

DR. RALPH O. RYCHENER reported a case of keratoconus complicated by hydrops of the cornea in a young woman, G. B. W., aged 16 years. On March 6, 1944, she was referred for treatment, showing the typical clinical picture of hydrops of the cornea of the left eye.

Daily paracentesis was performed at the temporal limbus for two weeks. The corneal edema measured 2 to 3 mm. between Bowman's and Descemet's membranes. A 10-percent solution of sodium chloride was used as an eye bath every two hours.

The patient developed hematuria with a hemoglobin of 68 percent and was transferred to Saint Joseph Hospital for urologic treatment. This condition eventually cleared and she was returned home with the cornea still edematous and vision reduced to perception of moving objects. On November 4, 1944, the visual acuity in the right eye was 4/60, improved with a —9.00D. cyl. ax. 60° to 6/60. The visual acuity in the left eye was 6/60, improved with a —2.50D. sph. to 6/12.

The cornea of the right eye showed a marked conical protrusion with deep corneal scarring centrally. The cornea of the left eye showed a nearly normal contour, with corneal scarring to the temporal side of the pupillary area. Apparently, fibrosis following hydrops had compensated for the original keratoconus.

IRIDOCYLITIS FOLLOWING TATTOOING WITH GOLD CHLORIDE

DR. RALPH O. RYCHENER reported a case of tattooing of the cornea for cosmetic improvement which resulted in iridocyclitis and eventual enucleation of the eye. E. H. D., aged 32 years, was seen April 20, 1944. The left eye was divergent from a penetrating injury of the cornea at the age of seven years. There was a linear scar of the cornea at axis 75°, covering the entire pupillary area with anterior synechia below. A traumatic cataract was present. The tension was 40 mm. Hg (Schiøtz). The vision was nil.

The patient was most conscious of the cosmetic appearance of the eye and tattooing of the cornea was done on April 21st, the superficial layers of the scar being excised and 20-percent gold-chloride solution and 20-percent tannic-acid solution applied with an applicator to the eroded area. An excellent golden brown stain of the affected area resulted. However, the eye never became entirely clear and retained a foreign-body feeling which was found to be due to minute sloughing of the impregnated metal. Eventually, it was necessary to remove all of the precipitated gold tannate, but the eye remained irritable, photophobic, and painful, and on October 2, 1944, was enucleated.

SIDEROSIS FOLLOWING INTRALENTICULAR FOREIGN BODY

DR. RALPH O. RYCHENER reported a case of siderosis of the eyeball following a penetrating injury to the cornea and lens. H. R., aged 13 years, was seen for the first time on January 4, 1945, because of failing vision in the left eye for the

previous month. Visual acuity was reduced to moving objects because of a traumatic cataract with iron-pigment deposits on the anterior capsule. A minute penetrating scar was visible in the central cornea, with a corresponding minute hole in the anterior lens capsule, and a dark object approximately 1 mm. in diameter could be seen with the slitlamp in the lower lens cortex. Repeated X-ray pictures were negative for intraocular foreign body. The patient was unaware of any previous injury to the eye but a history was elicited in which he recalled breaking up some iron with a hammer about a year previously. On January 12, 1945, a simple extraction was performed with keratome incision.

The lens capsule could not be grasped for intracapsular extraction but the lens cortex was expelled completely and contained some rust fragments and an oxidized foreign body, 1 mm. in its greatest diameter, which was attracted by close approximation with the giant magnet. Postoperative convalescence had been normal and visual acuity was 6/24 with correction.

X-RAY BURNS COMPLICATED BY GLAUCOMA

DR. E. C. ELLETT presented J. R., aged 55 years, who was seen in December, 1943, with an epithelioma at the lower outer limbus of the left eye. The right eye was normal. The vision of the left eye was 6/60, unimproved with lenses. A growth had been removed from the upper part of the limbus of the left eye, diagnosed grade-3 basal-cell epithelioma, and the operation was followed by X-ray treatment. In January, 1944, the patient had a dermatitis, and there was a faint generalized stain of the cornea of the left eye (fluorescein). He had more X-ray treatment and said he received 5 treatments in

one day and 10 on another day three weeks later. The patient was seen in January, 1945, when there were intense congestion of the eyeball, faint staining of the conjunctiva, and a dense white scar involving the lower and temporal conjunctiva and sclera. It was about 15 mm. in diameter and reached into the fornix. The pain was intense. The pupil was 7 mm. in diameter. The tension was 46 mm. Hg (Schiotz). A retrobulbar injection of novocaine and repeated paracentesis did not control the tension, and an iridectomy was done on February 12th, which reduced the tension. The eye was less red and not painful.

SENILE ECTROPION AND BOWEN'S DISEASE

DR. E. C. ELLETT presented Mr. P., aged 69 years, who had ectropion of both lower lids and a small pterygium on the lower portion of the left eye. From the lower edge of the pterygium a gelatinous substance swept around the cornea below to the temporal side, overriding the cornea about 3 mm. In the discussion of this case, Dr. Rychener and Dr. McKinney called attention to the condition as described by Wescamp of Argentina in the Archives of Ophthalmology (April, 1944).

CORNEAL TRANSPLANTATION FOR KERATOCONUS

DR. J. WESLEY MCKINNEY reported the case of Miss G. H., aged 30 years, who was seen in 1938 for an advanced keratoconus in each eye. The corneal protrusion was so marked in the right eye that a contact glass could not be worn. A molded contact glass, however, was fitted for the left eye. Because of the apical corneal opacity the best vision obtained even with the contact glass was 20/50 partially. In 1941, the cornea of the left eye had be-

come so weakened and the cone so marked that a contact glass could no longer be worn. In 1942, the patient experienced a sudden marked impairment of vision, with pain in the left eye. Examination revealed edema and opacification of the central portion of the cornea involving all the layers. This was a typical hydrops of the cornea resulting from the leakage of aqueous into the cornea through cracks in Descemet's membrane. This cleared up entirely in almost one month with the use of drops of hypertonic sodium chloride. In January, 1944, a corneal transplantation was performed in the left eye. Because of the thinness of the cornea it was very difficult to make as accurate an incision as is usually possible. The graft healed well except for a small area temporally where a fine fistulous tract remained. In July, 1944, this corneal fistula was closed by means of surgical diathermy applied with a very fine needle. Following this procedure the anterior chamber remained flat for about one week. As the anterior chamber re-formed the intraocular pressure rose and was controlled with difficulty with miotics. Consequently, a cyclodialysis was performed. Since this operation the tension has remained normal, and the graft has cleared to almost normal transparency. The vision improved to 20/30 and J4.

DISLOCATION OF LENS INTO ANTERIOR CHAMBER

DR. PHILIP M. LEWIS presented a patient with congenital subluxation of both lenses, one of which became dislocated into the anterior chamber.

E. A., a man, aged 30 years, was seen in September, 1944, for refraction. He was wearing $-5.00D.$ cyl. ax. 90° for both eyes. His vision was R.E. 20/200, L.E. 10/200. Both eyes showed iridodonesis, and the lenses were subluxated

upward and slightly medially. The media were clear and the fundi normal. Refraction showed that vision could be improved to R.E. 20/100 with $-4.00D.$ sph.; L.E. 20/200 with $-5.00D.$ sph. These lenses were prescribed, and he wore them with satisfaction for about two weeks. He then suddenly developed pain in his left eye and vision was blurred. A dense white haze was found in the center of the cornea involving the parenchyma and Descemet's membrane. The lens was in the same position as before. Dionin, atropine, and hot compresses were used, and the patient was examined for possible foci of infection. Some proptitis was discovered and he was treated by his physician. The eye became free from pain, but the cornea still had deep vertical lines of opacities, and the vision was very blurred. He continued at his work, but about once a week he developed a severe pain in the eye which lasted several hours. During that period the vision became very blurred and the eye congested. As these attacks happened to occur each time on a Sunday he was not seen until after the attack was over.

The true nature of these attacks was not discovered until November, when he was seen during one which had not subsided quickly, but on the contrary had lasted over 24 hours. The cornea was very steamy, the intraocular pressure 65 mm. Hg (Schiotz), and the lens was about three fourths in the anterior chamber. Thus the lens was jammed against the posterior corneal surface, and undoubtedly had been doing this to a lesser degree over a period of weeks and had been the cause of the deep corneal clouding. The patient was hospitalized immediately and within an hour the dislocated lens was removed. After healing was complete, the vision was 20/25 with $+13.50D.$ sph. Everything seemed enor-

mous to him and although he saw clearly for the first time in his life, it was very difficult for him to wear the strong plus correction. It was necessary to wear a frosted lens over the right eye to prevent diplopia. After three weeks he had become accustomed to his new glass, the size of objects, and the clear appearance of everything. With his distance lens he could also read J7 at arm's length and could see to do anything he wished except read fine print. A bifocal was not prescribed as it was considered unwise in his case. A separate glass was ordered for reading, +16.00D. sph., with which he read J2.

EARLY MULTIPLE SCLEROSIS

DR. PHILIP M. LEWIS presented R. L., a woman, aged 50 years, with possible early multiple sclerosis.

The patient was seen on December 4, 1944, with the complaint of blurred vision of her right eye for the past two weeks. She stated that she thought she had noticed a slight doubling of images at times. She had noticed no other symptoms and said that she was in good health. Vision was R.E. ability to count fingers, L.E. 20/25. The eyes were normal externally, the media clear, and the fundi normal except for a slight vascular sclerosis. The intraocular pressure was 18 mm. Hg (Schiotz) in each eye. Tests with a red glass and small light in the cardinal directions of gaze failed to reveal any diplopia. The visual fields were fairly normal by confrontation method. It was felt that the condition was probably a retrobulbar neuritis. She was sent to her physician for a complete examination and advised to return for careful studies on the perimeter and tangent screen.

The visual fields of the right eye, taken several times during a two-month period, showed a moderate concentric contrac-

tion. The left peripheral visual field remained normal. Both eyes showed paracentral defects, and the right a very minute central scotoma. The fundi had remained normal, and there had been no other ocular signs of disease. Central vision varied in the right eye from counting fingers to 20/50, although it usually remained about 20/100. In the left eye the vision was 20/25. General physical and laboratory studies were entirely normal. The result of a complete X-ray examination of the skull, sellar region, and paranasal sinuses was normal. The patient was referred to a neurologist with the information that early multiple sclerosis was suspected, but his findings were completely negative. Large doses of thiamine hydrochloride were given without result.

CENTRAL CHOROIDAL DISEASE

DR. PHILIP M. LEWIS presented a patient with a severe involvement of the macular region of unknown etiology. Mrs. W. J. W., aged 49 years, had been seen 10 months previously complaining that for two weeks she was seeing double and the vision of the left eye was blurred. Corrected vision was R.E. 20/20, L.E. 20/100. Examination showed that the right eye was entirely normal. In the left eye the cornea, iris, and lens were normal and the media were clear. The disc was normal and the retinal vessels were only slightly sclerosed. The macula was edematous, and there were several small hemorrhages and two small dull yellowish spots of exudate. Temporally near the equator were several old pigmented areas in the choroid. Complete general physical, dental, and laboratory examinations were negative. She was moderately sensitive to tuberculin.

Injections of tuberculin were given over a period of several months and for a while there was some improvement.

Vision improved to 20/50, and there were no fresh hemorrhages. Recently the condition had become worse. Fresh exudates, edema, and hemorrhages appeared in the macula, which had gradually become considerably scarred. A rather large hemorrhage also occurred along the inferior temporal vein below the macula. Among the various remedies tried in this case were injections of typhoid-H antigen intravenously, and large doses of vitamins. Nothing seemed to be of any value. It was questionable whether this was an inflammatory or degenerative condition.

IRIDOCAPSULOTOMY FOR POSTOPERATIVE MEMBRANES

DR. PHILIP M. LEWIS reported two cases of secondary membrane from postoperative iritis.

Case 1. Mrs. A. R., aged 65 years, had a combined extracapsular cataract extraction in April, 1944. On the second postoperative day the cornea was hazy, the aqueous turbid, and the eye highly inflamed. Treatment consisted of sulfadiazene internally, milk injections, dionin, hot compresses, atropine, and supragenin bitartrate. In spite of all efforts the borders of the coloboma became completely plastered down on a dense membrane. The intraocular pressure rose, and iris bombé developed two months after operation, necessitating transfixion of the iris. Following this, blood filled the anterior chamber and the eye was hard and painful. Paracentesis was performed and the blood evacuated. The eye gradually quieted down, leaving a very dense membrane. About four months after the original operation an iridocapsulotomy was performed, for which a narrow Agnew keratome and Berens modified Noyes scissors were used. Two months later the vision was 20/50 with +11.00D. sph. \approx

+2.00D. cyl. ax. 175° , and with +3.50D. sph. added she could read J6.

Case 2. Mr. T. B., aged 72 years, had a combined extracapsular cataract extraction of the left eye in April, 1944, and three days later a combined intracapsular extraction of the right eye. He went home on the eleventh day with both eyes in good condition, but a little cortex and capsular debris remained in the left eye. However, the fundus was clearly seen and no trouble was anticipated. He was given 1-percent atropine ointment to use in each eye once daily. On the fourteenth postoperative day the left eye became painful. Two days later there was a severe iritis with exudate and blood in the anterior chamber. A paracentesis was performed, with evacuation of the anterior chamber. Foreign-protein injections, dionin, hot compresses, atropine, and supragenin bitartrate were employed. Gradually the inflammation subsided, but the pupillary space was filled with organized exudate. The borders of the coloboma were plastered to the membrane so that iris bombé with increased intraocular pressure developed, necessitating transfixion of the iris.

Four months after the original operation an iridocapsulotomy was performed. Five weeks later the vision was 20/25 with +9.50D. sph. \approx +1.75D. cyl. ax. 180° , and with +3.00D. sph. added he read J2.

Comment. It was felt that dense secondary membranes, especially in cases in which it was necessary to cut the iris, were operated upon more safely and more successfully by keratome incision and snipping with scissors than by ordinary discission with knife needles.

CHICAGO OPHTHALMOLOGICAL
SOCIETY

February 19, 1945

DR. SAMUEL J. MEYER, *president*

SCIENTIFIC PROGRAM

POSSIBLE ERRORS IN THE USE OF THE
CROSSED CYLINDER

DR. IRVING S. PUNTENNEY discussed certain aspects of Williamson-Noble's recent paper on "A possible fallacy in the use of the crossed cylinder." Part of this work was repeated and photographs were presented which demonstrated that it is easier to make comparisons with the crossed cylinder between a clear image and a blurred image rather than between two images, both blurred but to an equal amount. It was also shown that blurred letters are more easily read when they are elongated in the vertical rather than the horizontal.

The underlying principles of Sturm's conoid as it applies to refraction were also demonstrated by a series of photographs. These photographs were used to illustrate the nature of the two principal planes, the circle of least confusion, size and shape changes of the diffusion circles, and the effect of the crossed cylinder on the size of the diffusion circles in mixed astigmatism. Having shown that size changes in the test letters can be compared but not both size and shape changes, the essayist recommended that the crossed cylinder be used only after establishing meridional balance. The duochrome method seems to be the only known way of consistently establishing meridional balance, and correcting crossed cylinders may also be used as they offer the advantage of both speed and accuracy. The following points were emphasized in the summary:

1. Fogged letters are easier to read when elongated in the vertical.

2. Elongation of test letters can be avoided by establishing meridional balance.

3. When astigmatism is present all refractive errors can be reduced to mixed astigmatism by the addition of plus or minus spheres.

4. Most patients can compare size changes in the test letters, but few if any can accurately determine the difference when both size and shape changes occur.

5. Reducing the distance between the focal lines reduces the size of the circle of least confusion, the smaller diffusion spots being the clearer.

6. The duochrome method seems to be the only known way of consistently establishing meridional balance.

7. Correcting crossed cylinders offer the advantages of both speed and accuracy.

8. The optics of the camera are not directly comparable to the optics of the eye, but studies of this type are valuable for demonstration and teaching.

Discussion. Dr. William A. Mann said that the first true crossed cylinder was devised by Stokes, a mathematician, in 1849. It consisted of equal plus and minus cylindrical lenses so mounted that they could be rotated to any axis desired, and it was suggested that by this means astigmatism could be determined. Little attention appears to have been paid to this idea by refractionists, however, until in 1886 Edward Jackson proposed the use of a crossed cylinder or, rather, spherocylinder, consisting of concave spheres with convex cylinders. The crossed cylinder was at that time advocated for use in determining the strength of the cylinder, and it was not until some 15 years later that it was realized that the axis of the cylinder could also be determined with great accuracy by this method.

Owing to the activity of Jackson,

Crisp, and others, the crossed cylinder has been widely adopted as an aid in subjective tests, and is recognized as one of our most valuable adjuncts in the art and science of refraction. It must be borne in mind, however, that it is a subjective test, and its usefulness is therefore limited by the power of observation and discrimination on the part of the patient. All who use the crossed cylinder routinely have encountered patients who seem unduly unreliable in their replies on this test, and have assumed a lack of discriminatory ability as the basis for their difficulty. This probably remains true, but Dr. Puntenney in his paper has suggested possible reasons for error. By photographic means he has adequately demonstrated the necessity of having the eye under examination meridionally balanced if the crossed cylinder is to be an accurate means of determining the strength of cylindrical correction necessary. Dr. Mann said that he had had no experience with the duochrome test; that it sounds excellent on theoretical grounds, but even without this test it should be quite possible to have the spherical correction exactly balanced, especially when the patient is under a cycloplegic and not subject to the variations in accommodation which may occur in a manifest refraction.

He congratulated Dr. Puntenney upon the photographic demonstration and for emphasizing possible errors which may arise with improper use of the crossed

cylinder. This in no way detracts from the important place of the crossed cylinder in subjective refraction, but does explain the need for its proper use. He asked Dr. Puntenney two questions: (1) Do these same errors arise in determining the axis of the cylinder as in the *strength* (this being the most important use for the crossed cylinder); and (2) in using the duochrome test, how satisfactory a method is it for establishing the meridional correction in a manifest refraction or post-cycloplegic refraction where accommodation may vary?

Dr. Irving Puntenney, in closing, said that regarding the subject of using the crossed cylinder for determining the axis, some work has been done on this, the approach being approximately the same. If meridional balance is maintained throughout the entire test, the axis determination will be more accurate, too, because the errors occur when both size and shape changes are introduced, thus leading to contradictory answers. He said that he had not used the duochrome until about one year ago; that he liked the old-fashioned vision box. However, at Dr. Gifford's suggestion he began to use it. He said he thought Dr. Gifford realized the possibilities of this long ago, and he was inclined to believe that it had helped him more nearly to approach the accuracy of Dr. Gifford's refractions.

Robert Von der Heydt.

AMERICAN JOURNAL OF OPHTHALMOLOGY

Published Monthly by the Ophthalmic Publishing Company

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THROUGH ENGLISH EYES

The fall sunshine was warm and pleasant, the road to Hot Springs curved gently among the soft Virginian hills, and the dinner menu of The Homestead was in itself a justification for 4,000 miles of travel. To your newest Assistant Editor the November meeting of the American Ophthalmological Society was an unforgettable experience. It was at once a flash-back to far-off days of friendly international meetings and a promise of a saner future. How earnestly we in Eng-

land desire a return to normality can only be realized by those of you who have seen the slow disintegration of prewar life and the gradual exhaustion of a stubborn people under burdens of controls, permits, rationing, universal conscription, and, finally, physical violence. To be snatched from all this to the friendly luxury and exhilarating vitality of America was to be awakened from a painful dream. But the awakening was all too brief, and the return to this land of poverty and post-war fatigue seems the more painful by

contrast. The memory, however, remains and should serve as a basis for a resolution to rebuild, to reconstruct, and to reorganize. One desideratum stands out, true for ophthalmology as for all other types of work, coöperation and collaboration. The Atlantic has narrowed to a span of hours, the continents are no longer individual nor safe in isolation. This should be the basis for an interchange of ideas, of personnel, of teachers, of students, of all that Britain and America have to give each other. This theme might well be developed into a study of the ways and means at present at our disposal. There is much to be done, and the times are urgent. It is good to be at home and planning for peace, not war.

Contrast and Cooperation. It is clear that at the moment the English-speaking world is fatigued but has already begun to realize the inevitable shortage of all medical practitioners, and of specialists. This is especially true of English ophthalmology, and the outstanding difference which a visitor to the United States sees there is in the size of the medical staffs of the teaching eye hospitals. Two examples will make this clear. Hospital A is in the United States. It has 75 beds and an annual out-patient attendance of 22,000. It has a total medical staff of 33, of whom 9 are resident and only 4 are absolute beginners. This makes each person responsible for about 15 cases a week, or, leaving resident staff out of the calculation, the visiting staff need only see at most 18 to 20 cases a week. Hospital B is in England. It has 50 beds and an out-patient attendance of 25,000 a year. Its staff is composed of eight medicals, namely two house surgeons, two surgeons, and four clinical assistants. Here each person must see at least 63 patients a week to keep things going. It is disparities of this nature which we in England must

remedy even before we acquire the modern buildings and equipment we so much need.

Another and interesting difference between the American and British outlook in teaching would appear to be that on one side of the Atlantic the aim is the very thorough and complete training of a relatively few high-grade specialists, while on the other side we aim at basic instruction of a larger number for a shorter time, leaving it to the initiative of the few to obtain for themselves the final gloss and polish of academic distinction requisite for the highest grade. That the ideal lies in a combination of the two attitudes is undoubted, and we may expect the influx of demobilized aspirant ophthalmologists to force the issue of the creation of a new and definite policy. This will on our side certainly aim at coöperation and at fostering travel and interchange of students and staff and at the provision of varying types of instruction, both didactic and practical.

The spirit of reconstruction is abroad, and our respective governments are alive to the need for providing instruction for those whose careers have been interfered with by the war. It is hoped that a plan will emerge in the near future which will do something at least to remedy the serious lack of practitioners of our speciality.

Ida Mann.

THE INTENSIVE COURSE FOR OPHTHALMOLOGIC TRAINING

As everyone knows who takes any interest in the training of ophthalmologists, there is, at the present time, a demand for instruction in the basic subjects and a demand for residencies which is overwhelmingly greater than the existing facilities. Medical schools and hospitals

have been urged to increase their quotas, but the response has not made a dent in the mass of applicants (see the editorial by Cordes in the January number of the Journal).

There has been pressure to relax the requirements for certification by the Boards—indeed, the Advisory Board of Medical Specialties has recommended something of the sort. This the Ophthalmic Board will not do. And yet, something should be done for these eager and ambitious students. Some of them are poor stuff and will bring no credit to ophthalmology. But no doubt some of them will become ophthalmologists of the highest grade. How shortsighted is the policy that is governed by a determination to exclude the poor ones rather than by a resolution to help the good ones! The policy of the American Board of Ophthalmology is the sound one of excluding the poor ones not by refusing to consider any applicant whose opportunities have been poor, but by subjecting him to careful scrutiny in the examinations and passing men whose opportunities may have been poor but who have made such good use of these poor opportunities that they have become so well qualified as to deserve certification. The fact that they have been able to qualify in spite of obstacles is one more evidence of their superior quality.

From time to time, special or emergency problems arise which require special handling. The Board has consistently urged that laboratory and what may be called university methods of instruction are the ideal and that short courses are an abomination—unsound pedagogically and productive of a poor grade of practitioner. They are, however, better than nothing and are capable of really good results under favorable conditions. These favorable conditions are

that the course be comprehensive, systematic, and fundamental—above all, with competent teachers. No one believes that clinical proficiency can be acquired in any way except by handling patients, certainly not by lectures. But for graduate students who have had four to six years of good medical training, including one or more years of internship or private practice or experience in the Armed Forces, the basic subjects of ophthalmology can be taught successfully by lectures, reading, and quizzes. Those who have been practicing ophthalmology will find in such a course a fine opportunity to brush up on their basic knowledge to their great profit.

As secretary of the American Board of Ophthalmology, Dr. S. Judd Beach receives the full impact of the applications as candidates beseech him to tell them what to do, which way to turn. When Ida Mann told him of her success with a lecture course for rather large classes at Oxford, he hoped he had found a solution to the emergency problem of the basic training in fundamental nonclinical subjects preparatory for residencies, many of which make no provision of their own for this training.

There was no time to lose, and already, in less than a month, the organization has been built and is being incorporated. The executive officers are Dr. Beach, Dr. Lancaster, Dr. Terry, Dr. Gundersen, and Lt. Col. Phillips Thygeson. A list of 25 or more advisers has been secured, and a splendid staff of lecturers, assistants, and quiz masters. If the course is the success we hope for, it will be because of the exceptionally competent teachers recruited not only from Boston, but from Maine to California.

We shall see whether it is possible in nine weeks of intensive work to cover the ground thoroughly and adequately.

Walter B. Lancaster.

OPPORTUNITIES FOR TRAINING IN OPHTHALMOLOGY

As of October 1, 1945, the Council on Medical Education and Hospitals of the American Medical Association listed 73 hospitals where otolaryngologic residencies, 56 ophthalmologic residencies, and 43 combined ophthalmologic-otolaryngologic residencies are offered. They are not sufficient, at least in so far as ophthalmology is concerned, to take care of the overwhelming immediate demand, nor very likely to satisfy the demand when the confusion of the present subsides. The long term does not particularly concern us at the moment. The disturbing present requires our attention to see what can be done to alleviate this intolerable condition.

Unquestionably, the stimulating and new Veterans' Administration program for residency training will partly solve this problem for us. It deserves careful scrutiny, and the candidate for ophthalmology should not overlook this opportunity, which may be better in many ways than some of the residencies offered by civilian institutions in so far as clinical material, training, supervised study, and research in ophthalmology are concerned.

At a recent meeting of the Advisory Board for Medical Specialties, Dr. Paul Magnuson, representing the Medical Department of the Veterans' Administration, mentioned that during the next 50 years about 18 million men and women will have been taken care of by the Veterans' Administration hospitals. It is general knowledge that the Veterans' Administration is building and planning to build its hospitals as near to medical centers as possible in order to take advantage of the greatest collection of good doctors. Most of these areas are to be found adjacent to a university and medical school. Mem-

bers of medical faculties of these schools will take active part in helping to staff the hospitals and in assisting in the residency-training program. The clinical material is very great and embraces all age groups. The exservice patients deserve the best of medical care and will get it, if the wise policies of Maj. Gen. Paul R. Hawley, Surgeon General of the Veterans' Administration, are followed. The battle is uphill and difficult, for there are many politicians, professional and amateur, whose philosophy has nothing to do with the ideals of good medical care, and their opposition is a delaying one. Generals Bradley and Hawley deserve every help and great commendation. One has faith that the public, if it knows the facts, will overwhelmingly back up these plans, everywhere.

To be sure, it will take a number of years to complete the building of new veterans' hospitals. However, the old ones are active, and residencies in ophthalmology in them are now available. Reorganizations of the staffs are being carried out, and new attending men and consultants are being appointed. It is good, too, to know that the problems of ophthalmology are in the capable hands of Dr. Trygve Gundersen, formerly consultant in ophthalmology, Mediterranean Theater, and to the Surgeon General of the Army, who has recently been appointed to the post of Chief Consultant in Ophthalmology to the Veterans' Administration. He is charged with the responsibility of organizing the ophthalmic services in the veterans' hospitals. These duties include matters of equipment, choice of consultants, and supervision of the residency-training program for ophthalmologists. It speaks well for the future that this able leader in ophthalmology is at the helm.

The ophthalmologists who are assigned

as attending men to the eye services of these hospitals have great opportunities not only for giving excellent care to the patients but also for developing to a very high degree the teaching facilities of the institution. The best places for the training of residents and internes are those that give the best professional care to the patients.

Let us return for a moment to the matter of the combined eye, ear, nose, and throat residencies mentioned before. A few of these are undoubtedly excellent and offer good facilities for men and women who are planning to do combined work. It is conceded that in small communities, particularly, there is a need for the eye, ear, nose, and throat specialist. There is one advantage at any rate, such an individual is never mistaken for an optometrist by the public. However, the average combined specialist has shown himself in the Army to be poorly equipped for top-flight ophthalmic work, and since these men came from civilian life the findings would be similar for the specialty as a group.

Perhaps some or many of the institutions giving a combined residency can be persuaded, during the emergency shortage of training facilities, at least, to divide their service into two, one for ophthalmology and the other for otolaryngology. This would be profitable to them in that more efficient service could be given, and a valuable boon to the neophyte ophthalmologist seeking a residency, particularly if he had had a basic course beforehand. The probable result would be a raising of the standards of ophthalmic practice among those doing part-time otolaryngology. It would mean a longer term of training for those seeking to be accomplished eye, ear, nose, and throat men; but there is no short cut without the sacrifice of training and skills.

Elsewhere in this issue* will be found an announcement from the American Board of Ophthalmology pertaining to preceptorships. It clearly establishes the policies of the Board in this matter, and puts it up to the student to make a wise choice of a preceptor. It recalls to mind a very attractive phase in the early history of medical education. It would have been a priceless privilege to be chosen pupil on one end of a log with Ernst Fuchs on the other, had he been available. Many a young man in the old days became a fine physician, trotting around with his preceptor on calls and in the office. A good preceptor must be very scarce. He has a reputation as a preceptor to establish and maintain, and if the pupil has to be wise in his choice, the preceptor should be most careful in his, too; for there is something very intimate and very filial in the relationship. One often judges the father by the son, and the son's manners are but a reflection of the old man's influence. A good preceptorship can be like an invaluable heritage, a poor one like a mismatched marriage. It can generate affection, loyalty, and respect or it can produce evil fruits on both sides. A responsive, talented, and eager pupil brings great joy to the preceptor's heart, and in this lies his reward for a difficult task. The future career of his pupil will be followed and supported for the rest of his days. He will know that some measure of immortality at any rate will be his for a time because the preceptor comes to life again at each phrase of his pupil's speech, each turn of his pupil's hand, and each word of an old inherited patient's affectionate memory.

Derrick Vail.

* See page 385.



OBITUARY
ALBERT D. FROST
(1889-1945)

Albert D. Frost, known to most of us as "Jack," was killed in an automobile accident near Monterey, Virginia, on his way home from the American Ophthalmological Society meeting in Hot Springs, Virginia, on November 15, 1945.

Born in Pittsburgh, Pennsylvania, on May 20, 1889, he received his preparatory education in the Pittsburgh schools, and in 1912 was graduated from the University of Pittsburgh with the B.S. degree.

He then worked in the steel mills for three years before he decided to enter medical school. Twice he enlisted in the Army and was twice sent back to medical school, and was graduated with the M.D. degree from the Western Pennsylvania Medical College in 1919. Following internship at Bellevue Hospital, Cornell Division, New York City, he spent a year and a half as resident in the New York

Eye, Ear, Nose, and Throat Infirmary. He became associated with the University of Pittsburgh and practiced ophthalmology in his home city until he moved to Columbus in 1924, to become an associate of Dr. Hugh Beatty.

Doctor Frost was a serious thinker. He possessed a keen clinical sense and dexterous hand to execute his plans. He was a resourceful and adroit surgeon. He loved teaching, particularly in the clinic, and his students were thoroughly instructed, in the use of the ophthalmoscope especially, and with contagious enthusiasm. He spared no effort nor convenience to give any student individual instruction merely for the asking. His place as a teacher will be difficult to fill.

"Jack" Frost was extremely friendly, loved to be with groups, and enjoyed, as much as anyone, to lead the chorus of his friends in amiable song.

He was an active member of numerous social, educational, and scientific organizations, contributing scientific discussions to the Columbus Eye, Ear, Nose, and Throat Society, Medical Review Club, Cleveland Ophthalmological Society, Ohio State Medical Association, American Medical Association, and, in particular, to the American Ophthalmological Society, in which he yearly participated. His other memberships included the International College of Surgeons and American Academy of Ophthalmology and Otolaryngology. He ably served for 10 years as a director of the Ohio Commission for the Blind, the last five years as its president.

His fraternal organizations included the Scottish Rite of Free Masonry, Sigma Chi, Phi Rho Sigma, and Alpha Omega Alpha. He was a Son of the American Revolution.

His social and educational memberships included Crichton Club, Young Business Men's Club, Kiwanis, City Club,

Athletic Club, Scioto Country Club, University Club, and Faculty Club.

In recent years he was mainly interested scientifically in the study of papilledema and made several noteworthy contributions on this subject. His published papers were not numerous, but of the highest quality and influence. His death is a real loss to everyone in ophthalmology and is a great loss to his home community, Columbus, Ohio.

A. D. Ruedemann.

CORRESPONDENCE

MEASUREMENT OF ABNORMAL RETINAL CORRESPONDENCE (A SIMPLIFIED METHOD)

Editor,

American Journal of Ophthalmology:

The measurement of abnormal retinal correspondence has often and unnecessarily been made to appear to be an abstruse subject. The idea that such is the case is apt to be fostered by the many articles on the subject in which it is stated or implied that one cannot determine the presence of abnormal correspondence or measure its degree without the use of a major amblyoscope or the afterimage test.

In using the major amblyoscope for this purpose, the examiner has the patient fixate alternately with one eye and with the other and adjusts the targets until they are in such a position that there is no movement of the eye on changing fixation. The patient is then permitted to adjust the instrument until the images of the targets are superimposed or until they change from a crossed position to a homonymous one or vice versa. The difference between this reading and the first one measures the amount of abnormal retinal correspondence. By this procedure there is obtained first an objective, then

a subjective measurement of the angle of squint.

This can be done in the same, or less, time with no other equipment than is used in the examination of any patient with a disturbance of ocular motility. The squint is first measured objectively with the cover test, then subjectively with the Maddox rod, and the degree of abnormal correspondence is the difference between the two findings. The examination with the Maddox rod is facilitated by placing the rod before one eye and a red glass before the other; also by darkening the room somewhat.

The examination as just described can be made, of course, only in patients whose visual acuity in the poorer eye is sufficient to permit central fixation. If central fixation cannot be held, the objective measurement must be made with one of the less accurate methods (perimeter, Priestley Smith tape).

(Signed) A. Russell Sherman
671 Broad Street
Newark, New Jersey

HOW CAN THE OPHTHALMOLOGIST DIVIDE THE BURDEN OF HIS PRACTICE BETWEEN HIMSELF AND HIS OFFICE HELP?

Editor,

American Journal of Ophthalmology:

If a patient is going to consult an ophthalmologist or, as a matter of fact, any physician, he expects and has the right to expect to be examined and treated by the doctor of his choice. Most doctors are very busy men (or women); their working hours are filled to capacity, and it seems only natural that they try to distribute the work to a certain extent between themselves and their nonmedical help. The question comes up, how far this division can be carried without doing

injustice to the patient, on the one hand, and harm to the medical profession, on the other.

Primarily, the duties of a doctor's secretary are well defined. She is expected to operate the telephone, to receive and register the patients in the reception room, to take care of the technical part of the doctor's practice, keep the patient's records and files straight and up to date, send out the statements at regular intervals as directed by her employer, watch all sorts of supplies and order replenishments if something is running low, and assist the doctor in the minor operations which he performs in his office.

In case the doctor has hired a trained nurse or a technician in addition to the secretary the orbit of activities of such personnel naturally will be considerably wider. A trained nurse may give subcutaneous or intramuscular injections under the doctor's strict supervision and responsibility. A technician may relieve him of most of his necessary laboratory work. If properly qualified, a technician may conduct orthoptic treatment of patients.

However, there are certain diagnostic and therapeutic duties which belong strictly in the realm of the doctor and should be carried out by him. The first and extremely important part of the whole procedure is the taking of case histories, which requires not only a great deal of technical, psychologic, and medical experience but also establishes the cherished, inviolate, and much-spoken-of patient-doctor relationship (which, by the way, has nothing to do with fees or with any other material compensation). The nurse may establish a few facts; such as, for example, when the patient got his last glasses, if any, and by whom he was referred. It is, however, the understanding questioning by the doctor and the understanding interpretation of the patient's

answers that build up a useful case history which alone furnishes the working basis for subsequent diagnosis and therapy.

It is not the purpose of this communication to discuss such duties as far as general practitioners and specialists in other fields are concerned. In what follows only the activities of ophthalmologists and their office staffs will be discussed. In my opinion all essential examinations should be carried out by the ophthalmologist—not by office girls or nurses—and these include not only ophthalmoscopy, retinoscopy, slitlamp examinations, but also subjective refraction, tonometry, and campimetry, to name only a few common diagnostic procedures.

I am very well aware of the fact that a certain number of eminent and nationally known ophthalmologists prefer to let an office girl or a nurse take care of some of these diagnostic procedures, especially tonometry and campimetry, the latter being a tedious and time-consuming undertaking if properly performed, which means that not only a peripheral field for gray objects, but also color fields, central field, enlargement of the blind spot, and possible scotoma are included in the examination. Every experienced ophthalmologist knows well what a vast amount of training and knowledge of physiology and anatomy, neurology, clinical pathology, and other branches of medicine are necessary to master the art of campimetry so thoroughly as to make the contribution of campimetry to the establishment of a proper diagnosis worthwhile.

To relate one of many rather typical experiences: A man, aged 30 years, was accompanied to my office by his wife. When he entered the examination room his somewhat ataxic gait immediately aroused suspicion. Questioning revealed that the patient had suffered a "nervous breakdown" four years ago, which meant

that he had shown a great variety of central nervous system symptoms, had been psychoanalyzed, had had his teeth pulled, his tonsils removed, and had had several pairs of glasses prescribed by an ophthalmologist; that he was sometimes better, sometimes worse. Eye examination revealed nystagmus in end positions, convergence paresis, definite pallor of the temporal sectors of both optic discs, deterioration of vision, and central scotoma for all values. When I telephoned the internist who had been taking care of the patient he hurried over to my office very much excited and depressed, bringing along several visual fields, old and recent ones, taken by the office girl in another ophthalmologist's office, which all showed normal peripheral limits. Based mostly upon the judgment of the ophthalmologist and upon the "normal" visual fields the diagnosis of malingering with an outspoken aversion to labor had been made, and the poor fellow had been treated accordingly for years. He died 11 months later from his multiple sclerosis. Had the ophthalmologist taken the trouble to examine the patient's eyes personally and properly the easy diagnosis would never have been missed.

There are in this country ophthalmologist's offices where admittedly the bulk of the refractive work is done by office girls who are only rather superficially acquainted with the fundamentals of refraction. I personally heard one eminent mid-western ophthalmologist, a medical school professor, at a special-guest lecture on the subject of glaucoma frankly advocate leaving tonometry in such cases up to nurses.

What applies to diagnostic measures is also true concerning therapy. I know offices of certificated ophthalmologists in which office girls without any medical training take charge the moment the doc-

tor is leaving town, not only for a day or two, but for weeks, giving typhoid shots, removing corneal foreign bodies, treating critical cases of glaucoma, corneal ulcers, and other serious lesions. Well, some doctors apparently think that such procedures are not only legitimate but also proper. The office girls have worked for them and with them for several years and have seen so many cases of this and that that they are well capable (in the doctor's opinion) to take care of the doctor's practice while he is away. Of course, it is quite possible that a fairly intelligent girl with high-school or even junior-college education can learn a number of clinical procedures. She may learn to irrigate and probe a tear duct, open abscesses, curette chalazions. Such knowledge and dexterity undoubtedly can be acquired by laymen.

However, there is one very serious implication. We, as members of the medical profession, are always watching for infringements by various groups of lay practitioners; that is, those who do not hold an M.D. degree and are not licensed to practice medicine. We are very much opposed to any transgression of limits by them. Optometrists are not permitted to use cycloplegics, anesthetics, nor any other drug. Reputable firms engaged in the manufacture of contact lenses are required to engage the services of an ophthalmologist who has nothing to do but put a drop of an anesthetic in the eyes in order to enable the technician to make the cast.

I do not advocate that technicians and optometrists be free to use all sorts of drugs in patients' eyes; on the other hand, I am strongly against the increasing habit of permitting office girls, technicians, and nurses to do any kind of diagnostic and therapeutic work which should be carried out by the ophthalmologist himself. Certain sudden emergencies

such as drowning, road accidents, and the like always call for the immediate help of laymen where the physician is not at once available. During this war a U.S.N. pharmacist mate at sea on a submarine successfully performed an appendectomy, using for the most part kitchen utensils. Babies have been delivered by young medics in occupied territories who had no previous experience nor knowledge of obstetrics. An attentive intelligent nurse who has seen a large number of iridectomies might be able not only to diagnose an acute glaucoma attack but even to perform the iridectomy. And that might be permissible in an isolated jungle outpost without medical officer. But it certainly is strictly contraindicated under regular civilian conditions. We may start in training a girl in refractive work, in taking visual fields, in tonometry, but where do we end? The next step would be ophthalmoscopy, then minor surgery, and finally the doctor may just perform the more expensive cataract, glaucoma, and retinal-detachment operations, leaving the rest of the diagnostic and therapeutic office activities to a nonmedical staff. That may sound fantastic but it isn't. I could enumerate many amazing examples of that sort.

If we do not take a firm stand, we are not only degrading the reputation of our profession, but we also are deliberately furnishing formidable weapons to all the various groups of nonmedical practitioners who always claim that they are at least as good if not better than the Doctor of Medicine. They will seize any occasion to point to the fact that our diagnostic and therapeutic methods do not have to be acquired in grade-A medical schools; since they can be easily acquired and used by untrained lay personnel who never went through a regular course of training in Medicine nor had

any postgraduate specialized training.

If doctors tell us that they do not have the time to perform personally all necessary diagnostic and therapeutic procedures, it can only be answered that no doctor can be forced to take more patients than he is able to handle, but that every doctor is compelled to diagnose and treat all his patients with the utmost care and that he must avoid everything that could be construed as unethical or detrimental to health-seeking humanity.

Especially now, when strong groups are working for introduction of systems of government-controlled medicine, it is of the utmost importance that the medical profession shall be in a position and eager to prove that we are really giving appropriate care to the whole population, that we are willing and able to take care of our own professional affairs without governmental interference.

Just as the specialists in all fields have established examining boards to which qualified specialists submit evidence of a minimum training, so it may become advisable to establish certain standards defining the duties of professional men in carrying on their practice. It will be better for the profession to take such matters in their own hands than to have them regulated later by governmental decree.

(Signed) F. Nelson
1121 North Tejon Street
Colorado Springs, Colorado

MILITARY OPHTHALMOLOGIC MEETING
HELD AT CRILE GENERAL HOSPITAL,
CLEVELAND, OHIO, NOVEMBER
28-30, 1945

A military ophthalmologic meeting was held at Crile General Hospital, Cleveland, Ohio, on November 28 to 30, 1945. Those present were ophthalmologists in the

Army and Air Force installations who have been vitally concerned with ophthalmologic problems; those who have made noteworthy contributions while in the Armed Forces, although they may now be inactive or on terminal leave; and civilian consultants who have contributed to surgery concerning military ophthalmology.

Following a short speech of welcome by Col. G. V. Emerson, Commanding Officer of Crile General Hospital, and Lt. Col. N. D. Hall, Chief of the Surgical Service of that Hospital, the meeting was called to order at 9:00 A.M.

The first day's program consisted of a symposium on "Orbital reconstruction."

The morning of the second day's program began with a presentation by Lt. Col. M. E. Randolph, Eye Consultant, Surgeon General's Office, Washington, D.C., and Chief of the Department of Ophthalmology and the Rehabilitation Center for the Blind at Valley Forge General Hospital. His topic was "Rehabilitation of the blind." The remainder of the morning's program was devoted to other special topics and original ophthalmologic contributions by various members present.

The afternoon of the second day was in charge of Lt. Col. P. R. McDonald, Executive, Medical Service Branch, Air Surgeon's Office, Professional Division, Washington, D.C. The papers for this session were presented by the outstanding ophthalmologists from the Army Air Force Medical Centers.

A dinner was held at the Cleveland Athletic Club on the evening of the second day.

The morning of the third day was devoted to a symposium on "Plastic surgery of the eyelids." The afternoon session consisted of papers, demonstrations, and discussions concerning localization and

removal of intraocular foreign bodies. All papers were limited to 20 minutes so that ample time for discussion was available.

The 41 ophthalmologists from various parts of the country who attended felt that the meeting was extremely worthwhile, and many expressed the hope that similar meetings in the different eye surgical centers could be held annually.

(Signed) Gilbert C. Struble,

Lt. Col. (MC) A.U.S.

Chief, Eye Surgical Center,
Crile General Hospital,
Cleveland 9, Ohio

PROGRAM

Wednesday morning, November 28, 1945. 8:30 Registration. 9:00: Col. G. V. Emerson, Commanding Officer, Crile General Hospital, and Lt. Col. N. D. Hall, Chief, Surgical Service, Crile General Hospital, "Welcome." SYMPOSIUM ON ORBITAL RECONSTRUCTION. 9:30: Lt. Col. Gilbert C. Struble, Chief, Eye Surgical Center, Crile General Hospital; "The use of tantalum and the Ruedemann eye implant in orbital reconstruction with presentation of cases;" 9:50: Discussion; 10:00: Lt. Col. E. L. Shiffet, Chief, Department of Radiology, Crile General Hospital, "The use of orbital tracings as an aid in reconstructive surgery of the orbit;" 10:20: Discussion; 10:30: Dr. A. D. Ruedemann, Chief, Department of Ophthalmology, Cleveland Clinic Hospital and Civilian Eye Consultant, Crile General Hospital, "Discussion on the use of tantalum and the implant eye in orbital reconstruction;" 10:50: Motion pictures of operative technique; 11:00: Capt. James Clifford, D.C., Chief, Acrylic Eye Laboratory, Crile General Hospital, "The processing of the Ruedemann implant eye;" 11:20: Discussion; 12:00: Luncheon at Officers' Mess, Crile General Hospital.

Wednesday afternoon, SYMPOSIUM ON ORBITAL RECONSTRUCTION. 1:00: Lt. Col. N. L. Cutler, Dibble General Hospital; "A new orbital implant;" 1:20: Discussion; 1:30: Major G. L. Witter, Dibble General Hospital; "The use of fascia lata in retro-tarsal atrophy following enucleation;" 1:50: Discussion; 2:00: Major A. J. Kreft, M.C., Billings General Hospital, "Orbital and ocular injuries produced by modern war missiles;" 2:20: Discussion; 2:30: Intermission; 2:40: Capt. B. F. Souders, Dibble General Hospital, "Elevation of orbital contents with plastic plates;" 3:00: Discussion; 3:10: Major G. L. Witter, Dibble General Hospital, "The use of dermal instead of fat implants in deep sockets;" 3:30: Discussion; 3:40: Major Victor H. Deitz, D.C., Chief, Plastic Eye Service, Halloran General Hospital, "The evaluation of recent ophthalmic concepts as related to the fabrication of plastic artificial eyes and implant devices;" 4:00: Discussion.

Thursday morning, November 29, 1945. 8:30: Lt. Col. M. E. Randolph, Eye Consultant, Surgeon General's Office, Washington, D.C., and Chief of the Department of Ophthalmology, Valley Forge General Hospital, "Rehabilitation of the blind;" 8:50: Discussion; 9:00: Major Trygve Gundersen, Eye Consultant, Surgeon General's Office, "The Vossious ring phenomenon;" 9:20: Discussion; 9:30: Major H. G. Scheie, Crile General Hospital, "Ocular changes in scrub typhus;" 9:50: Discussion; 10:00: Intermission; 10:10:

Lt. Col. O. W. Thoeny, Beaumont General Hospital, "Malignant tumor of choroid simulating cyst of optic disc;" 10:30: Discussion; 10:40: Major L. J. Croll, Fletcher General Hospital, "End results in the treatment of retinal detachments at Crile General Hospital;" 11:00: Discussion; 11:10: Capt. John S. McGavie, Valley Forge General Hospital, "Visual disturbances associated with head injuries or the treatment of uveitis with artificial fever;" 11:30: Discussion; 12:00: Luncheon in Officers' Mess.

Thursday afternoon, AAF PROGRAM. 1:00: Lt. Col. P. R. McDonald, Executive, Medical Service Branch, Air Surgeon's Office, Professional Division, Washington, D.C., "Testing of night vision;" 1:20: Discussion; 1:30: Lt. Col. Brittain F. Payne, Randolph Field, Texas, "Recent ophthalmic problems in the Philippine Islands;" 1:50: Discussion; 2:00: Major J. H. Allen, University Hospital, Iowa City, Iowa, "Dendritic keratitis;" 2:20: Discussion; 2:30: Intermission; 2:40: Capt. Richard G. Scobee, St. Louis, Missouri, "Ocular muscle balance in flying personnel;" 3:00: Discussion; 3:10: Lt. Col. Phillips Thygeson, AAF, Tampa, Florida, "Blepharitis in military personnel;" 3:30: Discussion; 3:40: Major S. Rodman Irvine, AAF Regional Hospital, Tampa, Florida, "Physiology of ocular movements;" 4:00: Discussion; 4:10: Lt. Col. John L. Matthews, AAF, Randolph Field, Texas, Open; 4:30: Discussion; 4:40: Major D. L. Edwards, AAF, Miami, Florida, Open.

Thursday evening, 7:00: Informal dinner; Cleveland Athletic Club.

Friday morning, November 30, 1945, SYMPOSIUM ON PLASTIC SURGERY OF THE EYELIDS. 8:30: Lt. Col. N. L. Cutler, Dibble General Hospital, "Correction of large notching defect of upper lid;" 8:50: Discussion; 9:00: Lt. Col. S. A. Fox, Newton D. Baker General Hospital, "Repair of lid margin deformities;" 9:20: Discussion; 9:30: Capt. A. E. Sherman, O'Reilly General Hospital, "Choice of procedure in ophthalmic-plastic surgery;"

"Free skin grafts vs. pedicle grafts;" "Repair of notch and colobomatous defects;" "Surgery of the lateral and medial canthus;" "Reconstruction of the entire eyelid;" "Correction of deformities of the eye socket;" "Eyebrow and eyelash grafts;" "Filling of defects of the orbital margin;" 9:50: Discussion; 10:00: Intermission; 10:10: Lt. Col. N. L. Cutler, Dibble General Hospital, "Transplantation of vitreous;" 10:30: Discussion; 10:40: Lt. Col. O. W. Thoeny, Beaumont General Hospital, "A method of surgical treatment of recurrent pterygium;" 11:00: Discussion; 11:10: Major George A. Filmer, Beaumont General Hospital, "An alternate method of eyelash transplant;" "Treatment of relaxed eyelids following enucleation;" "A case of myositis of the ocular muscles;" 11:30: Discussion; 12:00: Luncheon in Officers' Mess.

Friday afternoon, SYMPOSIUM ON INTRAOCULAR FOREIGN BODIES. 1:00: Lt. Col. Riwehun, Walter Reed General Hospital, "Removal of intra-ocular foreign bodies (magnetic and repair of detached retina);" 1:30: Discussion; 1:40: Major H. G. Scheie, Crile General Hospital, "Oxygen injection of Tenon's capsule as an aid in localization of intraocular metallic foreign bodies;" 2:00: Discussion; 2:10: Major Albert Abbott, Valley Forge General Hospital, "The use of the Berman locator in the removal of intraocular metallic foreign bodies;" 2:30: Discussion; 2:40: Lt. Col. Gilbert C. Struble, Chief, Eye Surgical Center, Crile General Hospital, "Technical refinements in the removal of magnetic intraocular foreign bodies from the posterior segment of the eye;" 3:00: Discussion; 3:10: Intermission; 3:20: Dr. A. D. Ruedemann, Cleveland Clinic Hospital, Cleveland, Ohio, "The role of beta radium in the treatment of pathology of the anterior segment of the eye;" 3:40: Discussion; 3:50: Lt. Col. Edward E. Burch, O'Reilly General Hospital, "Administrative problems and procedures in military ophthalmology;" 4:10: Discussion.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the *Ophthalmic Year Book*. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the *Journal*.

CLASSIFICATION

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| 1. General methods of diagnosis | 10. Retina and vitreous |
| 2. Therapeutics and operations | 11. Optic nerve and toxic amblyopias |
| 3. Physiologic optics, refraction, and color vision | 12. Visual tracts and centers |
| 4. Ocular movements | 13. Eyeball and orbit |
| 5. Conjunctiva | 14. Eyelids and lacrimal apparatus |
| 6. Cornea and sclera | 15. Tumors |
| 7. Uveal tract, sympathetic disease, and aqueous humor | 16. Injuries |
| 8. Glaucoma and ocular tension | 17. Systemic diseases and parasites |
| 9. Crystalline lens | 18. Hygiene, sociology, education, and history |
| | 19. Anatomy, embryology, and comparative ophthalmology |

10

RETINA AND VITREOUS

Bettman, J. W. **Allergic retinosis.** *Amer. Jour. Ophth.*, 1945, v. 28, Dec. pp. 1323-1328.

Damel, C. S., and Brodsky, M. **Arteriolar thrombosis of the retina.** *Arch. de Oft. de Buenos Aires*, 1943, v. 18, Sept., p. 429.

A man, 33 years of age, presented a thrombosis of a small arteriole in the macular region of the right eye, with moderate visual reduction. The neighboring arterioles showed discrete arteriosclerotic changes, but the rest of the retinal vessels were essentially normal. The patient was a chronic alcoholic and several days prior to the examination became unconscious and remained so for six hours. After considering embolism, endarteritis, periarteritis, and thromboangiitis obliterans, the authors arrive at the diagnosis of retinal arteriolar thrombosis, a nosological entity well established by Friedenwald. The pathology of the condition

is briefly reviewed. (5 illustrations, 3 tables, bibliography.)

Plinio Montalván.

Dellaporta, N. **Spontaneous recovery from a retinal rupture after shotgun injury.** *Klin. M. f. Augenh.*, 1942, v. 108, May-June, p. 363.

A man, 48 years of age, was accidentally hit in the right eye by a pellet from a shotgun. It was assumed that the pellet had pierced the sclera and lodged in the interior of the eye, although roentgenograms were not available. The fundus showed a grayish-white pear-shaped mass protruding from the retina. Adjacent to that spot a small diffuse retinal hemorrhage was found. An attempt to find the pellet through an incision in the lower part of the bulbar conjunctiva was unsuccessful. Three weeks later the gray mass had disappeared and a V-shaped tear in the retina with cloudy curled edges was found. Vision was 6/9 and the field of vision normal. The hole in the retina gradually became smaller

and disappeared completely after two months without any treatment. (References.)

F. Nelson.

Elwyn, H. Diabetic retinitis. *Arch. of Ophth.*, 1945, v. 34, Sept., pp. 187-190.

Diabetic retinitis, or retinopathy, is an easily recognizable ophthalmoscopic entity characterized by small, round and irregular hemorrhages; sharply defined, white exudates in the deeper layers of the retina, due to hyalin and lipids; and yellowish-white, glistening exudates, due to deposits of cholesterol.

The ophthalmoscopic picture is at times complicated by changes in the retinal vessels and their consequences, such as aging, arteriosclerosis, contraction of small vessels, obstruction of a venous branch, and episodal arteriospastic retinopathy. There is no causal relation between these changes and those of diabetic retinitis.

Some of the cases of severe diabetic retinitis are characterized by large retinal hemorrhages which rupture into the vitreous. A few cases are also characterized by the proliferation in the retina and the vitreous of newly formed vessels, which are covered by a connective-tissue layer. This form of retinitis proliferans differs in its appearance and its genesis from the retinitis proliferans following the partial absorption of a hemorrhage in the vitreous.

It is his opinion that in its pathogenesis diabetic retinitis stands in close relation to the continuous hyperglycemia which is in all probability responsible for the condition in the capillaries resulting in hemorrhages.

R. W. Danielson.

Franceschetti, M. A. Complete nonsyphilitic sclerosis of the retinal vessels. *Bull. Soc. d'Opht. de Paris*, 1939, Oct.-Dec., pp. 606-607.

A case of sclerosis of the retinal vessels in a man 49 years of age is discussed. He had had diminished vision in one eye since the age of six years, but severe eye symptoms did not develop until 25 years later. Then optic-nerve atrophy developed bilaterally with divergent strabismus, rotatory nystagmus, and complete sclerosis of the arteries and veins of the retina. The Wassermann reactions of the blood and cerebrospinal fluid were both negative. Cranial trauma might have produced this condition. It could also be a manifestation of atypical tapetoretinal degeneration without consanguinity of the parents. Morton R. Cholst.

Magitot, A. Mechanism of the stellate retinopathies. *Ann. d'Ocul.*, 1941, v. 177, no. 11, pp. 395-414.

The many conditions which produce stellate retinopathies are basically due to circulatory disturbances with mechanical and chemical variants. These are hydromechanical pressure of venous and arterial blood, osmotic pressure, the composition of the blood, and the presence of toxic products. Cellular degeneration is brought about by the accumulation of toxic products in the fluids which bathe the retinal cells, especially in the inner layers. Anoxemia and other insufficiencies play an important part because of high retinal glycolysis. The macula is predominantly involved because of the radial arrangement of its vascular structure and nerve fibers. White exudates are largely due to fibrin deposits and the accumulation of granular detritus in macrophagocytic microglial cells. The cells, which frequently form large clumps, are crammed full of lipoids, and giant cells are common in clumps. Vascular lesions can almost always be found, par-

ticularly in the smaller arterioles and the vessels. Hemorrhages are due to transudation, and not to rupture of the vessel walls.

Chas. A. Bahn.

Moeschlin-Sandoz, Y. **Histologic structure of the vitreous ring.** *Klin. M. f. Augenh.*, 1942, v. 108, May-June, p. 310.

Vogt's vitreous ring is seen frequently in senile eyes and in axial myopia. Histologic studies of the structure of the ring formation have never been published. The author reports his histologic studies of three eyeballs which had shown prepapillary ring formation clinically. One eye was enucleated because of malignant melanoma of the choroid, the two others belonged to a 73-year-old male who died of an intestinal carcinoma. All three eyes showed identical histologic findings. There was spindle shaped splitting of the posterior hyaloid membrane with invasion of cells having the form, structure, and tinctorial characteristics of glia cells, which proves that the strand composing the ring formation as seen ophthalmoscopically is glial in nature. (9 microphotographs, 1 color plate with 3 figures, bibliography.) F. Nelson.

Reese, A. B., and Payne, F. **Persistence of primary vitreous.** *Amer. Jour. Ophth.*, 1946, v. 29, Jan., pp. 1-24.

Terry, T. L. **Ocular maldevelopment.** *Jour. Amer. Med. Assoc.*, 1945, v. 127, June 23, p. 582.

Over 10 percent of infants born very prematurely or weighing three pounds or less can be expected to be blind from retrolental fibroplasia. A large mass of fibrous tissue develops in the hyaloid system. In addition to the mass one finds microphthalmia, shallow or absent anterior chamber, fetal blue iris,

thin ciliary processes, persistent hyaloid artery, retinal separation, searching nystagmus, and photophobia. Of the probable causes listed, premature exposure to light is considered most probable and should be avoided. Treatment has been unsatisfactory. Many such eyes have been removed because the lesion was mistaken for retinoblastoma.

Morris Kaplan.

Vancea, P., and Lazarescu. **Retinal folds caused by pressure from a mucocele of the frontal sinus invading the orbit.** *Klin. M. f. Augenh.*, 1942, v. 108, May-June, p. 354.

The authors report a case of a large mucocele in a male 54 years of age which after two years duration had invaded the orbit, causing ptosis of the upper lid, proptosis and dislocation of the eyeball downward and outward, as well as restriction of the eye movements. Vision was reduced to 1/50. There was papilledema and retinal hemorrhage, and 10-12 horizontal and parallel folds of the retina were seen running across the macular region towards the disc. After surgical removal of the mucocele the eye returned to its normal position, and after ten days the retinal folds began to disappear. A hyperopic astigmatism found to be 2.5D. before the operation decreased to 2.0D. It is probable that the retinal folds as well as the increased corneal astigmatism were produced by direct pressure exerted by the mucocele on the eyeball. (1 fundus picture, bibliography.) F. Nelson.

11

OPTIC NERVE AND TOXIC AMBLYOPIAS

Cooper, Fred. **Early diagnosis and treatment of primary optic atrophy.**

The Eye, Ear, Nose, and Throat Monthly, 1944, v. 23, Feb., pp. 68-71.

It is estimated that one tenth of our population is infected with lues and that five percent of the syphilitics develop tabes. It is believed that there are 50,000 cases of primary optic atrophy which are due to acquired lues. Prevention becomes an important problem, and to this end an early diagnosis and immediate treatment seem essential, although opinions differ on this point. The routine ophthalmologic procedures needed to establish a diagnosis are described in detail. The etiologic factors other than lues are enumerated as well as the theories concerning its pathogenesis. He mentions the possible relationship between neurologic changes and vitamin deficiency, and the theory that optic atrophy may develop as a result of nutritional disturbances of the nerve due to a luetic involvement of the blood supply of the optic nerve. The writer discusses different types of local and general treatment and points out that in unilateral luetic optic atrophy an early diagnosis and immediate treatment will in most cases prevent blindness in the fellow eye. Hyperpyrexia induced by malaria is a very efficacious method in the treatment of primary optic atrophy, and tryparsamide is contraindicated in cases where there is actual or potential damage to the optic nerve. (References.)

M. Lombardo.

Halbertsma, K. T. Arteriosclerotic atrophy of the optic nerve. *Ophthalmologica*, 1942, v. 104, Dec., pp. 289-300.

A case of bilateral arteriosclerotic optic atrophy in a woman 53 years of age is reported. The author discusses the theories concerning the mechanism of this type of atrophy. While some

authors hold that the nerve damage is due to inflammation and stasis, the writer emphasizes the effect of pressure by arteriosclerotic vessels. The internal carotid and ophthalmic arteries as well as the vessels surrounding the optic nerve can damage the nerve.

Max Hirschfelder.

Lijó Pavia, J. Prepapillary cyst. *Rev. Oto-Neuro-Oft.*, 1944, v. 19, Oct., pp. 125-131.

The author feels, as do other American observers, that these cysts originate from Cloquet's canal, and dilate as they develop. Two cases of typical prepapillary cyst are reported, both occurring in adults, one in each sex. They were best observed with the binocular ophthalmoscope, which readily demonstrated their anterior protrusion into the vitreous. Both patients had reduced vision, due probably to trophically unhealthy retinas resulting from partial closure of the arteries. Visual-field studies showed enlargement of the blind spot. The author reemphasizes the value of binocular ophthalmoscopy for proper diagnosis and study. (4 retinographs, bibliography.)

Edward Saskin.

Loewenstein, A. Cavernous degeneration, necrosis and other regressive processes in optic nerve with vascular disease of eye. *Arch. of Ophth.*, 1945, v. 34, Sept., pp. 220-226.

Several explanations of cavernous degeneration in the nerve have been advanced. The first is that the condition is the result of increased intraocular pressure; another that an abnormal lytic process is at work, the result of lysins which are liberated in the intraocular fluid of glaucomatous eyes (Elschnig). The author's findings lead

him to think that these two views are untenable, for cavernous change is not limited to the prelaminar and the immediately postlaminar part of the nerve. Usually the changes to be described are situated at some distance from the lamina cribrosa as well as near it. It has also been suggested that cavernous degeneration is the result of ascending degeneration in the nerve, a sequel of destruction of fibers at the disc associated with glaucoma, but in this case the cavernous change should present a continuity of degeneration, and its intensity should be greatest near the disc.

Loewenstein stresses that cavernous degeneration in the nerve is but one of the pathologic changes he has found in his study. The others were necrotic and sclerotic alterations.

This paper is a report of the histologic study of six glaucomatous eyes. Two points engaged the attention of the author as the result of the study of these six cases. The first is the occurrence of subretinal prolapse of optic-nerve tissue as a result of disease processes in the nerve. The second, and major, point of interest is the variety of forms of degeneration appearing consistently in the nerve in association with profound vascular disease.

Special attention, in the study, was given to the pathologic types of degeneration in the optic nerves, and the observations are described in some detail. Cavernous and necrotic degeneration were almost consistently found, and frequently the two changes occurred together. They were sometimes present in marked degree; at others they were inconspicuous. In some cases the disease process exceeded the boundaries of the nerve head and extended into the subretinal space.

These observations led Loewenstein to conclude that all these degenerative changes are the result of vascular damage with impairment of nutrition rather than the effect of increased intraocular pressure. R. W. Danielson.

13

EYEBALL AND ORBIT

Offret, G. Anatomic study of a complex retrobulbar embryonic malformation. *Arch. d'Ophth.*, 1945, v. 5, no. 1, p. 8.

The autopsy specimen studied came from the orbit of a newborn baby and was unique because of the presence of embryonic lid elements lying posterior to the globe. This poorly developed lid structure included such elements as skin, mucous membrane, hair follicles, and sebaceous, sweat, and mucous glands, as well as lobules corresponding to a rudimentary lacrimal gland. In addition there were a number of cysts, some probably representing dilated excretory ducts and others epithelial inclusion cysts. The author differentiates this formation from the ordinary dermoid cyst, which it resembles in many respects, on the basis of the multiplicity of the cystic cavities, the variety of the glandular structures, the resemblance to an eyelid, and the location in the muscle cone which is an unlikely one for a dermoid. He places the tumor intermediate between a dermoid cyst and a teratoma.

Phillips Thygeson.

Offret, G. Primary malignant tumors of the orbital musculature. *Arch. d'Ophth.*, 1941-42, v. 4, no. 1-2, p. 1; and no. 3-4, p. 81. (See Section 15, Tumors.)

Shoji, Y. A case of primary epitheli-

oma of the meibomian gland with invasion of the orbit and destruction of the globe. *Arch. d'Opht.*, 1941-42, v. 4, no. 1-2, p. 32. (See Section 15, Tumors.)

Vancea, P. and Lazarescu. Retinal folds caused by pressure from a mucocele of the frontal sinus invading the orbit. *Klin. M. f. Augenh.*, 1942, v. 108, May-June, p. 354. (See Section 10, Retina and vitreous.)

Velter, M., and Mergiot de Trigny, P. Acute unilateral exophthalmos in a newborn infant. *Bull. Soc. d'Opht. de Paris*, 1939, Oct.-Dec., pp. 569-570.

An infant, born one month prematurely developed a marked swelling of the upper eyelid, slight exophthalmos, and chemosis shortly after birth. Soon afterwards, the lower eyelid became swollen and chemosis and exophthalmos increased. Biopsy specimen revealed normal tissue, although gross inspection suggested an angioma. The cornea of this eye remained normal despite the severe protrusion. The infant presented no other signs of malformation. Morton R. Cholst.

Wright, A. D. Pulsating exophthalmos. *Proc. Royal Soc. Med.*, 1945, v. 38, July, p. 479.

A case of traumatic pulsating exophthalmos is presented. Twelve days after the accident the internal carotid artery was ligated. Five minutes later hemiplegia and aphasia developed. The ligature was removed with prompt recovery of movement and speech. After seven days the common carotid was tied and the eye rapidly returned to normal. However, its sight was lost during the time between the two operations. Morris Kaplan.

EYELIDS AND LACRIMAL APPARATUS

Desvignes, P., and Offret, G. Tumors of the lacrimal-sac region. *Arch. d'Opht.*, 1945, v. 5, no. 1, p. 25.

The diagnosis of lacrimal-sac tumor is difficult and is usually made only after invasion of surrounding structures. Two illustrative cases are reported. In the first case diagnosis of basal-cell epithelioma was made three years after removal of the sac for dacryocystitis. The authors believe it possible that the original stenosis was of neoplastic origin. In the second case the patient presented apparent mucocele of the sac with fistula formation. Tumor was suspected when the fistula failed to close normally under treatment. Microscopic examination revealed a basal-cell epithelioma with limited extension. The authors point out that lacrimal-sac tumors develop in two phases; first, dacryostenosis and dacryocystitis without unusual characteristics, and second, tumefaction. Tumor is to be suspected if the swelling is particularly hard or if there is spontaneous bleeding from the puncta. Tumors generally are not painful and there is no adenopathy. They may invade the nasal fossa, the orbit, or the skin. Phillips Thygeson.

Folk, M. R., and Brunner, H. Edema of the eyelids in infections of the paranasal sinuses. *Illinois Med. Jour.*, 1945, v. 87, May, p. 245.

Lid edema due to infections of the paranasal sinuses might be due to an osteitis of the sinus walls or to thrombophlebitis of the anastomosing vessels. The former is more frequent in old people, the latter in young ones. The

frontal sinus is scarcely developed before the seventh year of life. In young children, therefore, lid edema is caused by infection of the maxillary sinus or the anterior ethmoid. In fact, lid edema is the most conspicuous sign of ethmoiditis in infants or young children. As the phlebitis extends backwards into the orbit, symptoms like high fever, exophthalmos, meningeal symptoms may appear and give the impression of a severe illness. These symptoms, however, disappear after simple conservative measures, such as shrinkage of the nasal membrane and the administration of sulfa drugs. If, however, the infection, while spreading backwards into the orbit, causes a subperiosteal abscess, the disease will continue for a longer time, and exophthalmos, displacement of the eye, and transitory muscle paralysis will become more prominent than the lid edema. Even in these cases surgery should be postponed as long as possible and one should rely on conservative measures and sulfa drugs. If one has the chance to see the lid edema develop, some conclusions of practical importance can be drawn. Maxillary-sinus infection involves the lower lid first, frontal and ethmoidal infections involve the upper lid first. Lid edema due to dacryocystitis is localized below the inner palpebral ligament, that due to ethmoiditis is localized above the palpebral ligament and over the frontal process of the maxilla from which the edema extends outward. In frontal-sinus infection the edema starts in the mesial or lateral portion of the upper lid.

Four case histories are given.

R. Grunfeld.

Leopold, I. H., Mahoney, J. F., and

Price, M. L. Symmetric defects in the lower lids associated with abnormalities of the zygomatic processes of the temporal bones. *Arch. of Ophth.*, 1945, v. 34, Sept., pp. 210-214.

The literature is discussed and a case report is given in which symmetric defects in the outer third of each lower lid, with absence of the zygomatic processes of the temporal bones, as shown roentgenographically, occurred in a grandparent, mother, and daughter. The ancestral history of these cases suggests that the defect was hereditary and that the trait is a dominant one.

R. W. Danielson.

Nuri Fehmi Ayberk. Suppurative and cystic bilateral dacryocanaliculitis in an old trachomatous inflammation. *Göz Klinigi*, 1945, v. 3, Aug., pp. 1-4.

A woman of 55 years, with old trachoma, had a suppurative canaliculitis with cystic dilatation of both upper eyelids. The author has seen this complication in only 30 out of 1,050 patients suffering from trachoma. (References.)

W. H. Crisp.

Shoji, Y. A case of primary epithelioma of the meibomian gland with invasion of the orbit and destruction of the globe. *Arch. d'Opht.*, 1941-42, v. 4, no. 1-2, p. 32. (See Section 15, Tumors.)

15

TUMORS

Castañé Decoud, D. D'A. de. Choroidal melanomas. *Anales Argentinos de Oft.*, 1944, v. 5, Oct.-Nov.-Dec., pp. 123-135. (See Section 7, Uveal tract, sympathetic disease, and aqueous humor.)

Dejean, C. Unrecognized intraocular tumors. *Arch. d'Opht.*, 1941-42, v. 4, no. 1-2, p. 38.

The author calls attention to the difficulty of diagnosing intraocular tumors at onset, particularly in elderly individuals, and cites the relative frequency of tumors in eyes enucleated because of glaucoma. He reports his own series of 14 eyes, all enucleated for glaucoma. Two of these, on section, showed malignant melanoma of the choroid. The first of these was enucleated because of chronic glaucoma with repeated inflammatory exacerbations; vision was nil and the fundus could not be seen. The tumor was found to fill almost the entire vitreous cavity. In the second eye vision was likewise nil, and the fundus was obscured by a pupillary membrane. The entire vitreous was found to be replaced by a melanoma which had not been suspected.

On the basis of these two cases and a survey of the literature, Dejean reviews the objective and subjective signs of intraocular tumor. Among the subjective signs he includes localized field changes, metamorphopsia, micropsia, muscae volitantes, and phosphenes; as objective signs he describes corneal precipitates, pupillary paralysis, melanotic deposits on the iris, retinal detachment, and faulty transillumination. A sign of particular importance is the poor compressibility of the sclera over a tumor. The author stresses the frequency of tumor in progressive unilateral painful glaucoma which resists miotics.

Phillips Thygeson.

Humayer, Karl. Improvement of visual disturbances caused by pituitary tumor after mastoid operation. *Klin.*

M. f. Augenh., 1942, May-June, v. 108, p. 335.

A female of 36 years came for treatment of otitis media and beginning mastoiditis in January, 1933. Previously she had been given several X-ray treatments for a large pituitary tumor of extrasellar origin which had been diagnosed in 1929 and which had already destroyed the dorsum of the sella. Vision and bitemporal hemianopsia had improved after each treatment, but the improvements never lasted more than a few months. Mastoid operation eventually became imperative. When the necrotic parts of the bone of the sinus plate were removed the dura of the cerebellum was laid open. Five days after the operation the visual fields and the visual acuity improved, so that the patient could read again. After one year the visual acuity was 5/5 and 5/7 in the right and left eye, respectively, and the visual field of the right eye still showed a hemianopic defect for white and colors in the upper temporal quadrant. During the following eight years no further X-ray treatment became necessary, and the patient was completely free of any disturbances. The incomplete atrophy of both discs did not change. It is assumed that the success of the operation resulted from the removal of bony structures which produced a decompression of the brain, the optic nerves, and chiasm.

F. Nelson.

Lagrange, H. A case of tuberculous dystrophic osteitis of the skull. *Ann. d'Ocul.*, 1941, v. 177, no. 7, pp. 263-270.

A male 37 years of age had a tumor of the right frontal region with normal vision, a left exophthalmos with optic atrophy, and a vision of 4/200. X-ray

studies showed a rarification of the right frontal bone and a similar area in the occipital region. A tumor biopsy specimen contained giant cells, from which several tubercle bacilli were isolated. Guinea-pig inoculation tests verified the tuberculous etiology.

Chas. A. Bahn.

Monbrun, Offret, G., and Guillaume, J. Value of examination of the sheath membranes in tumors of the optic nerve. *Arch. d'Opht.*, 1945, v. 5, no. 1, p. 8.

Careful examination of the meninges of the optic nerve in nerve tumors is strongly recommended. Two cases of optic-nerve glioma are reported by way of illustration. In both, histologic study of the tumors themselves was rendered difficult because of degenerative changes in the tumor substance, but examination of the meninges revealed characteristic tumor-cell infiltration. The detailed histologic study is documented by numerous drawings.

Phillips Thygeson.

Offret, G. Primary malignant tumors of the orbital musculature. *Arch. d'Opht.*, 1941-42, v. 4, no. 1-2, p. 1; and no. 3-4, p. 81.

This extensive review in two parts is based on 25 cases from the literature, plus an additional two cases observed by the author. Five cases of fibroblastic sarcoma are described of which three were verified histologically and two were doubtful. The tumors were all in young subjects and involved three different rectus muscles. In each case diagnosis was made only after surgical removal. It was not possible to conclude as to local recurrence or metastasis, as postoperative observations were

incomplete, but it is believed that such recurrences are the rule. In the five cases the clinical signs and symptoms varied considerably, while the microscopic picture was relatively uniform.

A single case of polymorphic sarcoma with total involvement of the superior rectus in a child of two years is reported. There were ten cases of rhabdomyosarcoma. Typical and atypical forms were recognized by the microscopic appearance. Of the ten cases, seven were in infants or young children, two were in adults. Two clinical types were noted; the first became superficial early and simulated palpebral, conjunctival, or limbic lesions; the second, whose neoplastic nature was discovered only on biopsy, remained deep and was evidenced by exophthalmos. These neoplasms recur readily and frequently become generalized. Radiotherapy is of value.

Only two cases of leiomyosarcoma are reported and in both the diagnosis was open to some doubt. Seven cases of round-cell sarcoma, of which six occurred in individuals of from 32 to 61 years of age, are recorded. The clinical picture of orbital neoplasm with exophthalmos was uniform in all cases. In general these tumors are radiosensitive and have a favorable prognosis. Adequate follow-ups were not available but local recurrence was noted in only one case and was relieved by radium.

The author states that reticulosarcomas of the orbit, and particularly of the orbital musculature, are extremely rare but he reports two cases, one of which was his own. This tumor is radiosensitive and the prognosis is good.

In a general discussion of the subject, Offret stresses the fact that nor-

mal muscle function is well maintained in spite of extensive invasion of the muscles and that disturbance is generally due to nerve involvement.

Phillips Thygeson.

Shoji, Y. A case of primary epithelioma of the meibomian gland with invasion of the orbit and destruction of the globe. *Arch. d'Ophth.*, 1941-42, v. 4, no. 1-2, p. 32.

The literature on malignant tumors of the meibomian gland is reviewed and the eight cases which have been reported from Japan are described in detail. The author's patient was a woman of 69 years who had a chalazion-like nodule of the right lower lid of five years duration. This tumor slowly increased in size until it surrounded the globe, destroyed the lower lid, and invaded the lateral half of the upper lid. It had grown to the size of a man's fist. Over the temporal part of the tumor the skin had disappeared, leaving a bleeding ulcer. The tumor on extirpation weighed 48 grams and surrounded the atrophic globe. Microscopic examination showed that the tumor was an epithelioma. Its origin from the meibomian gland was well shown by the lipoidal content of the characteristic cells, demonstrated by fat stains and by the polarizing microscope. The study is well documented by photographs and drawings.

Phillips Thygeson.

Vetter, Joachim. A metastatic choroidal carcinoma from cancer of the breast in a male. *Klin. M. f. Augenh.*, 1942, v. 108, May-June, p. 349.

Of the 150 cases of metastatic carcinoma of the choroid reported up to 1939 60 to 70 percent originated from primary tumors of the breast but only

once in a male. The author saw a man of 69 years in whose left breast carcinoma with metastasis in the axillary lymph nodes had been diagnosed two years previously. Operation had been refused. A large retinal detachment was found in the right eye. The eye was enucleated and the metastatic carcinoma of the choroid was demonstrated histologically. Subsequently the primary tumor was removed surgically but a roentgenogram revealed metastases in both lungs. (3 microphotographs. Bibliography.)

F. Nelson.

Wiedersheim, O. Two rare angiomatous lesions in the fundus. *Klin. M. f. Augenh.*, 1942, v. 108, March-April, pp. 205-213.

The author reports observations on two eyes that showed a mass of dilated convoluted vessels contiguous to the disc which extended out far beyond the macula. In one of them the anomalous vessels seemed to have extended into the depths as though connected with the choroid. A year later the vessels had collapsed and the swelling in the involved area had receded, presumably as a result of strangulation from pressure which the mass itself exerted on its blood supply.

The author speculates on the relations between racemose arteriovenous aneurysm and retinal angiomatosis and their theoretical significance. (4 figures, references.)

F. Herbert Haessler.

16

INJURIES

Amsler, Marc. Direct ocular lesions through skiing accidents. *Bull. Soc. d'Ophth. de Paris*, 1939, Oct.-Dec., pp. 595-599.

Fourteen cases of trauma to the eyes

due to skiing accidents are discussed. Direct lesions are produced by either the ski poles or the point of the ski itself. The lesions consisted of contusions and detachments of the eyelids, paresis of the ocular muscles, exophthalmos, enophthalmos, and various injuries to the eyeball itself. Nine eyes were rendered useless. The author declares skiing a most dangerous sport.

Morton R. Cholst.

Benkwith, K. B. Eye injuries and diseases encountered during Iwo Jima campaign. U.S. Naval Med. Bull., 1945, v. 45, Sept., p. 433.

The problems of the diagnosis and treatment, and some general observations of the 81 eyes injured in the Iwo Jima campaign are presented in moderate detail. In most of these there were recent, serious trauma with multiple infective foreign bodies in the eye and the surrounding tissues. Although the eyes were observed and treated for only one to three days before evacuation to the rear, the results were dramatic. In addition to the necessary surgical treatment, most patients received large doses of sulfadiazine orally, 30,000 units of penicillin intramuscularly every three hours, and penicillin applied locally. Calcium penicillin was freshly prepared in concentrations of 10,000 units to the c.c. and used topically, injected subconjunctivally over the whole globe, injected into the vitreous body in amounts of 0.2 c.c., and used as an irrigation solution of the anterior chamber. The very excellent therapeutic results are ascribed to the routine use of these heroic measures combined with very tight pressure bandages.

Morris Kaplan.

De Saracibar, Jose M., Varices of

Gent. Arch. de la Soc. Oft. Hisp.-Amer., 1945, v. 5, Jan., pp. 50-53.

Gent described irregular dilations of the conjunctival blood vessels produced by the caustic effect of mustard gas. The author describes an eye with identical clinical picture though no history of contact with a caustic chemical could be obtained.

J. Wesley McKinney.

Esposito, A. C. Ocular sensitivity to butyn. Amer. Jour. Ophth., 1945, v. 28, Dec., pp. 1362-1364.

Jäger, A. Eye injuries caused by owls. Klin. M. f. Augenh., 1942, v. 108, May-June, p. 346.

A man of 55 years was attacked by an owl. In the right eye the lens became partially dislocated; the left eye sustained a conjunctival and scleral non-perforating wound. Vision in the right eye was first considerably reduced, but both eyes recovered full vision eventually. (Reference.)

F. Nelson.

Rouquier, A. Amaurosis and amblyopia as a result of posttraumatic reflex sympathetic disturbances of the face. Presse Medicale, 1945, July 28, p. 412.

The case of a soldier wounded by a mine explosion is reported. About 15 small pieces of stone had penetrated the skin of the face, chiefly on the left side. None of these had struck the eyes, penetrated the orbits, or damaged the optic nerves. The soldier had at no time lost consciousness and had not sustained a brain concussion. A bilateral blepharospasm, much more marked on the left side, developed during the days following the explosion, and at the same time the left eye became almost totally blind while vision in the right dropped to 3/50. The left pupil was smaller than

the right but reacted normally. Neurologic examination revealed sympathetic disturbances more marked on the left side. The electro-encephalogram showed alterations localized to the two prerolandic regions, more marked on the left side.

Treatment consisted in the injection of acetylcholine and in cocaine applications to the middle turbinates. Under this regime the patient's difficulties slowly resolved so that vision had become normal in both eyes and the blepharospasm had disappeared two and a half months after injury. Repeated electroencephalograms continued to show abnormalities, however, but their extent diminished steadily. Rouquier states that this would have been called a case of hysteria a few years ago but that neurologists now recognize the reflex sympathetic nature of the lesion. The amblyopia is believed to be due to circulatory changes in the retina. Phillips Thygeson.

Sédan, J. Total, unilateral, external ophthalmoplegia following electric short circuit. *Ann. d'Ocul.*, 1942, v. 178, no. 2, pp. 64-71.

No similar observation has been reported. An electrician, 27 years of age, was badly shocked when a short circuit occurred in a transformer which reduced a current from 5,000 to 110 volts. A total external unilateral ophthalmoplegia resulted, with partial paralysis of the seventh nerve. Improvement began about the forty-fifth day with slight restoration of the sixth-nerve function. All muscular function was entirely restored in four months.

Chas. A. Bahn.

Valerio, M. Two rare cases of juvenile degeneration of the cornea. *Bull.*

Soc. d'Opht. de Paris, 1939, Oct.-Dec., pp. 612-614.

Two young men, 25 years of age, with no significant family history, each had a disciform corneal opacity. In one of them microscopic examination revealed gray-yellow polygonal elements in Bowman's membrane which had the appearance of a mosaic. In the other, microscopic examination revealed crystalloid deposits in the parenchyma of the cornea. The author believes that senile alterations can take place at an early age as an expression of a recessive hereditary degeneration.

Morton R. Cholst.

Wright, A. D. Pulsating exophthalmos. *Proc. Royal Soc. Med.*, 1945, v. 38, July, p. 479. (See Section 13, Eyeball and orbit.)

17

SYSTEMIC DISEASES AND PARASITES

Balza, Jorge F., and García Querol, Armando. Ocular changes in pregnancy. *Arch. de Oft. de Buenos Aires*, 1943, v. 18, April, p. 216; June, p. 311; July, p. 356; Aug., p. 411; Sept., p. 464.

This is a very exhaustive review of the subject, appended by 65 detailed case histories and presented in the following sections: general considerations, glaucoma and pregnancy, myopia and pregnancy, intraocular pressure in pregnancy, pressure of the central retinal artery in pregnancy, visual fields in pregnancy, accommodation and light sense in pregnancy, ocular changes in septic abortion, ocular changes in hyperemesis gravidarum, retinal detachment in pregnancy, sudden blindness in pregnancy, hypertensive retinosis in pregnancy, ocular changes during labor and puerperium, case reports, and sum-

mary. From their studies the authors arrive at the following conclusions:

(1) Glaucoma is extremely rare in pregnancy. (2) Myopia may appear or if present may increase during pregnancy. Calcium metabolism probably plays an important role in this connection. (3) Intraocular pressure was found to be within normal limits. (4) The pressure of the central retinal artery was normal in all cases with normal systemic blood pressure and was increased in arterial hypertension. (5) No definite visual-field defects were found. (6) No investigation of accommodation and light sense in pregnancy could be carried out. (7) No ocular complications were observed in septic abortion. (8) Hyperemesis gravidarum was complicated with retinal hemorrhages. (9) Retinal detachment during pregnancy may be of three types: (a) ordinary retinal detachment occurring during pregnancy without symptoms of toxemia, requiring ocular surgery by the standard procedures; (b) retinal detachment with symptoms of toxemia, a typical complication with characteristic symptoms requiring immediate therapeutic abortion; and (c) retinal detachment occurring during or after labor in which a predisposing cause such as myopia is usually present. (10) Sudden blindness in pregnancy may be due to hysteria, but is usually associated with eclampsia, when the blindness may last hours or even days. (11) Hypertensive retinosis is the most frequent ocular complication of pregnancy. It appears usually during the second half. Its earliest signs are arteriolar spasms and increased pressure of the central retinal artery. If it appears before the fetus is viable and there is no improvement with systemic treatment, therapeutic abortion must

be resorted to. When the retinosis appears after viability, if the retinal lesions are discrete and show a tendency to regression under treatment, it is advisable to await the termination of pregnancy; on the other hand, if the retinal lesions are extensive, with no improvement under systemic treatment, the pregnancy should be interrupted. (12) The normal eye tolerated pregnancy well. (1 diagram, 2 color fundus pictures, 8 fundus photographs, 4 tables, bibliography.)

Plinio Montalván.

Berens, C., and Cumming, E. L. N. Nasal bacteriologic flora in eye patients. *Amer. Jour. Ophth.*, 1945, v. 28, Dec., pp. 1313-1321.

Cibis, P. Cataract in neurodermitis disseminata. *Klin. M. f. Augenh.*, 1942, v. 108, May-June, p. 281. (See Section 9, Crystalline lens.)

Dollfus, M.-A. Value of phlycentular conjunctivitis in the detection and prophylaxis of infantile tuberculosis. *Arch. d'Ophth.*, 1941-1942, v. no. 1-2, p. 26. (See Section 5, Conjunctiva.)

Gersh, I., and Reich, N. E. Arthritis, urethritis, and conjunctivitis (Reiter's disease.) *Urologic and Cutaneous Rev.*, 1945, Aug., p. 472. (See Section 5, Conjunctiva.)

Giqueaux, R. E., and Ochoa, R. G. Ocular myiasis. *Anal. Argentinos de Oft.*, 1944, v. 5, July-Aug.-Sept., pp. 79-83.

A 3-months-old infant is discussed from whose right eye many larvae were removed. These worms presented themselves only when exposed to chloroform fumes. There was subacute

conjunctivitis, with the larvae residing in the folds of the plica semilunaris. A discussion of general myiasis and ocular myiasis follows. (2 illustrations.)

Edward Saskin.

McGraw, James L. Marfan's syndrome with unusual complications. Arch. of Opht., 1945, v. 34, Aug., pp. 112-113.

The author reports a case of Marfan's syndrome, occurring in a family in which three of six children were mentally deficient, and one of the three showed other congenital defects, among them, ectopic lenses.

The patient, a girl, had ectopic lenses, apathetic expression, prominent ears, thin, flat chest, winging of the scapulas, and spinal curvature. The tension was elevated in one eye with partial dislocation of the lens but was normal in the other eye in which the lens was completely dislocated. Seven months after a lens extraction from one eye a large anterior-chamber cyst developed associated with a rise in tension. The cyst was successfully destroyed by flushing it with 3.5 percent iodine solution. John C. Long.

Mukerji, A. K., and Bhaduri, N. V. Gnathostome infection of the eye. Indian Med. Gazette, 1945, v. 80, p. 126.

A Bengalee Hindu male 26 years of age complained of a dull, aching pain on the left side of his nose and left frontal region for a week. Next day a swelling appeared on the left cheek which spread to the left lower eyelid. Physical examination revealed orbital cellulitis, but normal vision. Two days later the cellulitis improved, the vision, however, dropped to perception of hand movement. Hemorrhages in the retina and in the vitreous were noted. Three

days later a severe iritis with small grey nodules on the iris developed. The nodules soon disappeared but a definitely motile pigmented mass made its appearance on the iris. From the angle of the anterior chamber a worm of 2 1/2 cm. length was removed which belonged to the genus *Gnathostoma* (Nematoda). The parasite resembled the species described by Maplestone and differed somewhat from *G. spinigerum* and *G. hispidum*.

The parasite, and the life cycle of *G. spinigerum* are described. In Bengal men usually acquire it by eating raw or dried fish. R. Grunfeld.

Pérez Vélez, A. A. Oral infection and ophthalmology. Rev. Oto-Neuro-Oft., 1944, v. 19, Oct., pp. 141-143.

A concise, informative discussion of dental anatomy and physiology is presented. The intimate relationship between the orbital and dento-buccal vascular, lymphatic, and nervous systems may account for ocular disease due to dental foci of infection. In certain ophthalmic problems, it is wise to have a complete dental examination, including X-ray study, and to remove immediately any infections in the mouth. Edward Saskin.

Radnot, Magda. Eye findings in Cushing's disease. Ophthalmologica, 1942, v. 104, Dec., pp. 301-307.

Adenomata of the anterior lobe of the hypophysis may compress the optic nerve and lead to bitemporal hemianopsia, edema of the retina, and retinal hemorrhages. The latter can be the result of arterial hypertension. In addition to these findings the author stresses the possibility for increased intraocular pressure due to disturbance

of the endocrine system. Three cases of Cushing's disease with swelling of the face, decrease in calcium of the bones, low sugar threshold, and arterial hypertension are reported. Two of them showed elevation of the intraocular pressure. Max Hirschfelder.

Schmelzer, Hans. The problems of ocular tuberculosis and its treatment. Arch. de la Soc. Oft. Hisp.-Amer., 1945, v. 5, Jan., pp. 24-42.

There are still many unsolved problems in the field of ocular tuberculosis. Cases of true caseous ocular tuberculosis are extremely rare. The great majority of chronic inflammatory processes in the eye are not true tuberculous affections but are tuberculoallergic. Occasionally allergy to other organisms is causative. The treatment, then, is directed toward desensitization by specific and nonspecific therapy. Rest and diet are fundamental adjuvants. Graduated injections of tebe-protein are preferred for specific therapy, guided by frequent blood counts which indicate the state of allergy by the white-cell picture. As nonspecific therapy, copper or gold is used intravenously, often with the addition of calcium. J. Wesley McKinney.

Schwartz, A. R. Exophthalmic goiter in children. Arch. of Pediatrics, 1945, v. 62, May, p. 214.

A case of exophthalmic goiter in a child two years and three months of age is reported because of the rarity of the condition. R. Grunfeld.

Shannon, E. W., and Soloman, J. Bilateral temporal arteritis with complete loss of vision. Jour. Amer. Med. Assoc., 1945, v. 127, March 17, p. 647.

In a patient with acute bilateral tem-

poral arteritis all vision in both eyes was promptly lost. Resection of the affected portions of the arteries relieved all symptoms but the loss of vision. Fundus studies showed venous engorgement, blurred disc margins, papillary and retinal edema, threadlike arteries, and some minute hemorrhages. The cause of the ocular involvement is not clearly understood though it is suggested that the retinal artery undergoes the same pathologic processes which are found in the temporal artery.

Morris Kaplan.

Spaeth, E. B., and Krewson, W. E. III. Arteriovenous aneurysms in the region of the circle of Willis. Jour. Internat. College Surg., 1945, v. 8, July-Aug., p. 313.

An anatomic and physiologic review of the circle of Willis is presented with stress on its ophthalmologic aspect. There are five types of aneurysm of this structure and all of them give rise to ocular signs and symptoms. The diagnosis is difficult in all types and most often is not made until after rupture and death. Arteriosclerosis, trauma, and syphilis are the etiologic agents in most cases. Arteriovenous aneurysms, on the other hand, are relatively easily diagnosed and offer considerably more hope of repair. Exophthalmos with pulsation and bruit are the cardinal and almost constant symptoms. The therapy of choice is ligation of the common carotid artery with subsequent ligation of the internal carotid. (Bibliography of 363 references.) Morris Kaplan.

Spies, T. D., Perry, D. J., and others. Ocular disturbances in riboflavin deficiency. Jour. Lab. and Clin. Med., 1945, v. 30, Sept., p. 751.

The results presented are of a two-

year study of riboflavin deficiency conducted in the Nutrition Clinic at Hillman Hospital of Birmingham, Alabama, by the Departments of Internal Medicine and Ophthalmology of the University of Cincinnati. Ninety percent of patients reporting to the clinic suffered dietary deficiency and of these 70 percent complained of visual disturbances. Five hundred eye patients were treated, of which 300 are reported in this paper. The general symptoms were nervousness, insomnia, headache, burning and aching of legs and feet, burning and cramping of stomach, constipation, burning of the skin, and general inability to do physical work. The ocular symptoms were itching and burning of the eyes, failure of visual acuity, photophobia, lachrimation, conjunctivitis, and night blindness. Dilatation of conjunctival and corneal vessels, corneal ulceration (53 percent interstitial keratitis (60 percent) and pterygia (50 percent) were found. In spite of these signs and symptoms no pathognomonic picture of the disease could be made. The pathogenesis of the deficiency is not understood but the response to riboflavin was unmistakable. Three detailed case reports are given to show that the response to riboflavin in advanced stages of the disease was dramatic. Of the 300 patients 72 percent were able to return to work after months or years of idleness. (Bibliography.)

Morris Kaplan.

Stine, G. H., and Draper, P. **Horner's syndrome.** *Rocky Mountain Med. Jour.*, 1945, v. 42, July, p. 504.

A review of the anatomy and the etiologic factors involved in Horner's syndrome is presented. The symptoms are described. The differential diag-

nosis of the spastic miosis by means of an analysis of the pupillary responses to autonomic drugs such as acetylcholine and adrenalin is presented in detail. In a man who developed the syndrome after mumps encephalitis complicated by a head injury, the instillation of adrenalin was followed by a temporary recovery. The lesion was postganglionic, probably the result of a thrombosis of the internal carotid artery.

Morris Kaplan.

Taylor, W. O. G., and Fergusson, A. G. **Dermatitis from wearing Army spectacles.** *Brit. Med. Jour.*, 1945, July 14, p. 40.

Six cases of dermatitis are presented. The British Army spectacle frames are made of nickel silver, which is an alloy of nickel, copper, and zinc and is plated with nickel. In each case the dermatitis commenced promptly upon wearing the glasses, occurred in the areas of contact with the frames and healed promptly after removal of the glasses or a change of the frame. It was concluded that the dermatitis was an allergic reaction to ionized nickel which was freed by electrolysis in the presence of acid sweat aided by the body heat.

Morris Kaplan.

Valenta, A. **Sudden bilateral blindness of luetic origin.** *Klin. M. f. Augenh.*, 1942, v. 108, May-June, p. 339.

A 53-year-old male lost vision in both eyes within 24 hours. Only a slight remnant of light perception was left which was completely lost two days later. Pupils were wide and inactive, but both eyes were otherwise normal. Neurologic examination and roentgenograms were negative. The Wassermann reaction in blood and

spinal fluid was strongly positive. Two days later bilateral papillitis developed with retinal hemorrhages in the left eye. Antisyphilitic treatment and vitamin-B injections were started immediately. Sixteen days after the onset of the blindness light perception returned and nine days later fingers could be counted. Optic atrophy developed. Subsequent improvement of functions could not be followed up since the patient withdrew from further observation. It might be assumed that a gumma had formed in the chiasm, or that a non-specific agent had caused a transverse optic neuritis in the body which had been rendered less resistant by the chronic infectious syphilitic process.

F. Nelson.

18

HYGIENE, SOCIOLOGY, EDUCATION,
AND HISTORY

Boshoff, P. H. Blindness and diseases of the eye in South Africa. South African Med. Jour., 1945, v. 19, May 12, p. 148.

In 1938 the ratio of blind per 100,000 in the United States was 51.8 while in South Africa it was 400 for the nation and reached 2,000 in some districts. He states the amount of money spent for pensions in a rather makeshift system of registration and insists that if some of that money were used to subsidize well-trained ophthalmologists who would practice among the natives, the figures of blindness could be greatly reduced. The plea continues for postgraduate ophthalmologic facilities in their two medical schools, since no such facilities exist in the entire nation.

Morris Kaplan.

Bücklers, M. Ophthalmologic race hygiene according to Lisch. Klin. M. f.

Augenh., 1942, v. 108, March-April, pp. 155-160.

Apparently Lisch expressed some extreme views on the subject. Bücklers criticizes him most scornfully and analyzes the individual case histories which Lisch used as illustrations. (References. F. Herbert Haessler.

Chenoweth, C. Rehabilitation of the deaf and blind. Jour. Iowa State Med. Soc., 1945, v. 35, Oct., p. 392.

The newly blinded casualty is assured a psychologic and emotional support by special consultant at the first hospital of residence. A temporary training program is arranged to bridge the time until the newly blinded soldier is sent to one of two special centers. At the center the soldier is taught how to dress and shave, how to feed and care for himself. He is taught the use of a typewriter. The talking book and radio offer much enjoyment before he learns Braille. Occupational therapists teach him to use his hands, to develop new skills and dexterity and thus assist in restoring confidence through useful work. When the patient has learned to get about readily he is encouraged to enlarge his social contacts.

Experience shows that only ten percent of the blind can use Seeing Eye dogs advantageously. Many blinded soldiers will develop the ability to get about inconspicuously with a minimum of assistance and a skillfully used cane.

Following the initial training, the direction of schooling depends greatly on a patient's native ability, intelligence, and past education. The government will send any blind man through college who is able to qualify.

Theodore M. Shapira.

Cowen, J. P. Optical service units of the Navy. *War Med.*, 1945, v. 8, July, p. 18.

The two types of optical units used by the Navy are described. The large, permanent-base type, and the smaller, semipermanent mobile type. By their use the supplying, replacing, and repairing of spectacles has been carried directly to personnel in the field. They do no examining or treating but satisfactorily produce the average, single-vision spectacles required by the Navy.
Morris Kaplan.

Eames, T. H. Eyes of premature children. *Amer. Jour. Ophth.*, 1946, v. 29, Jan., pp. 57-63.

Feiman, E. M. Rehabilitation of the blind. *Indust. Med.*, 1945, v. 14, Aug., p. 649.

In the Timken Roller Bearing Company of Canton, Ohio, totally blind employees check bearings which must be accurately ground to one twenty-five millionth of an inch. These bearings are checked in an electronic device which for the sighted operator automatically switches on lights of various colors to denote under, over, or acceptable dimensions. For the blind operators, the company invented a sound detector, which emits notes of different pitch from a small speaker mounted on the back of the chair of the operator. The Timken Company offers this apparatus without royalties to any industry willing to employ the blind for such work.

Morris Kaplan.

Gasteiger, H. Sterilization of individuals with hereditary cataract. *Klin. M. f. Augenh.*, 1942, v. 108, March-April, pp. 161-166.

Gasteiger discusses the law which relates to sterilization and the pertinent ophthalmologic data which concern the inheritance of cataract and the amenability to treatment of hereditary forms. He believes the practice of the majority of oculists is sound; namely, to refrain from sterilization of patients with uncomplicated, hereditary cataract and good surgical prognosis. (References.) F. Herbert Haessler.

Gradle, Harry. Graduate training in ophthalmology. Jackson Memorial lecture. *Trans. Amer. Acad. of Ophth. and Otolaryng.*, 1945, Sept.-Oct., pp. 10-13. (See *Amer. Jour. Ophth.*, 1946, v. 29, Jan., pp. 24-28.)

Hardy, L. H., and Rand, G. Elementary illumination for the ophthalmologist. *Sight-Saving Rev.*, 1945, v. 75, Spring, p. 30.

A guide is presented for the ophthalmologist who might be called upon to conduct a survey of existing lighting or to advise for lighting to be installed. A complete definition of terms is followed by a discussion of principles on which judgment may be based. These principles include intensity, quality, contrast, distribution, and glare. An easily comprehended practical discussion of fluorescent lighting is also included.

Morris Kaplan.

Keller, P. Blindness in Tonkin. *Arch. d'Ophth.*, 1941-42, no. 3-4, v. 4, p. 101.

Visitors to Indo-China are struck by the frequency of blindness among the seven million inhabitants of Tonkin, but no statistics as to cause and frequency have been available. Keller, who is director of the Ophthalmological Institute of Hanoi, has analyzed the findings in 14,000 patients drawn from

a population of approximately 100,000. The gonococcus proved to be the principal cause of blindness and the author has outlined a detailed plan of prophylaxis whereby each case of purulent ophthalmia could be detected early and treatment started. Other causes of blindness are analyzed in chart form and the total number of totally blind in the province is estimated to be 22,470 with 30,030 blind in one eye.

Phillips Thygeson.

Kranz, H. W. Indications for sterilization of individuals with cataract. *Klin. M. f. Augenh.*, 1942, v. 108, March-April, pp. 145-155.

Kranz, not an ophthalmologist but director of the University Institute for race hygiene at Giessen, outlines the principle which underlies a decision to bring about sterilization of an imperfect individual. He discusses each type of cataract and points out that less than ten percent justify sterilization.

F. Herbert Haessler.

Lueck, I. B. Vision in industry. *Amer. Jour. Ophth.*, 1946, v. 29, Jan., pp. 63-72.

New, G. B. The fiftieth anniversary of the Academy. Address of the president. *Trans. Amer. Acad. of Ophth. and Otolaryng.*, 1945, Sept.-Oct., pp. 7-9.

Since April 1896, when Dr. Hal Foster organized the first meeting of the Academy, until the present, the membership has increased from a very small group to 3,700. The many advantages which the Academy offers its members are discussed in detail, and the numerous forms of instruction which are presented, including motion pictures, are discussed at some length. The advances which have been made during the war

will be reflected in future programs and will assure even greater interest and educational value than in the past.

Chas. A. Bahn.

Pepper, O. H. P. Modification of a blood pressure apparatus for use by the blind. *Arch. of Ophth.*, 1945, v. 34, Aug., pp. 113.

This is a description of an apparatus developed by J. O. Kleber of the American Foundation for the Blind. It consists of a modification of the Tycos spring sphygmomanometer with a plastic bristle and elevated pegs so that the instrument may be used by the blind. Two illustrations.

John C. Long.

Polack. Tscherning and his work. *Annales d'Ocul.*, 1940, v. 177, May, pp. 179-187.

Tscherning died on September 1, 1939, the day of the beginning of World War II. Polack's obituary has only just become available for American readers.

Born in 1854, on a Danish island, Tscherning's early thesis on the etiology of myopia led to his appointment as Assistant Director in Javal's laboratory at Paris. He obtained his Doctorate in Medicine in 1887, with a thesis on the law of Listing; was naturalized a Frenchman, was made Chevalier de la Légion d'Honneur, and in 1910 was made Professor at the University at Copenhagen, resuming his Danish nationality. In 1890, Tscherning presented to the Société Française d'Ophthalmologie a new apparatus called "ophthalmophakometer," the purpose of which was to determine the radii of curvature of the crystalline lens, its distance from the cornea, and the form of its posterior surface. In the same year he presented a study on the in-

fluence of spherical aberration on the refraction of the eye, a subject which had not previously received attention. In 1892 he published the first results of his researches on accommodation. His lessons on physiologic optics, delivered at the Sorbonne, were published in 1898. In 1904 he presented to the International Congress of Ophthalmology the first results of his researches on color vision, in which he questioned the adequacy of Young's theory of color vision. (A 2-page chronologic list of Tscherning's works; portrait.)

W. H. Crisp.

Rötth, A. de. Analysis of 1,000 new eye patients. *Amer. Jour. Ophth.*, 1945, v. 28, Dec., pp. 1329-1334.

Wetzel, J. O. Rehabilitation of the blind. *Jour. Michigan State Med. Soc.*, 1945, v. 44, Aug., p. 820.

The author presents his plan for the State of Michigan in the rehabilitation of the blind.

Prevention: (1) early examination and treatment; (2) sight-saving classes; (3) enforcement of safety laws under all conditions which may endanger eyesight; (4) revamping existing state laws by competent ophthalmologic authority to make eye examinations of the potentially blind obligatory.

Rehabilitation: (1) extend services to every blind person who can possibly be restored to employment; (2) extend knowledge of the great capabilities of blinded workers, properly trained, so

that employers and the public will have greater confidence in them.

Theodore M. Shapira.

19

ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Deringer, M. K. The results of homoplastic, heteroplastic, and xenoplastic transplantation of the optic vesicle in *Triturus* and *Rana*. *Jour. Nat. Cancer Inst.*, 1945, v. 5, June, p. 437.

Experiments performed by the author confirmed the results of previous investigators that in all amphibians at the tail-bud stage the optic vesicle has complete powers of self-differentiation; that is, when it is transplanted to an unusual position, it is able to form an eye with all its characteristic parts, usually in their normal relations. Occasionally, however, various abnormal relations were established. Distortion of the retinal layer, displacement of the lens, and failure of the optic nerve to connect with the host brain were common. The abnormal relations were fewer in homo- and heteroplastic but more frequent in xenoplastic (between individuals of widely distant species) transplantation. The transplanted eyes had a normal, although slightly smaller, appearance and the optic nerves were connected with the brain. In xenoplastic transplantation the transplanted tissue became differentiated into retina and lens, but underwent degeneration and in some cases disappeared entirely.

R. Grunfeld.

NEWS ITEMS

Edited by DR. DONALD J. LYLE

904 Carew Tower, Cincinnati 2

News items should reach the editor by the twelfth of the month.

DEATHS

Dr. Theodore J. Dimitry, New Orleans, Louisiana, died October 26, 1945, aged 66 years.

Dr. Chester H. Fairchild, Woodland, California, died September 6, 1945, aged 74 years.

Dr. Benjamin W. Hazell, Baltimore, Maryland, died October 3, 1945, aged 73 years.

Dr. Alexander G. Hough, Beaver Dam, Wisconsin, died September 26, 1945, aged 75 years.

Dr. Orville K. Kaylor, Saint Louis, Missouri, died October 24, 1945, aged 72 years.

Dr. William R. Knabe, Orleans, Massachusetts, died September 10, 1945, aged 66 years.

Dr. Everett A. Land, Norfolk, Virginia, died October 30, 1945, aged 65 years.

Dr. John G. Shimmom, Cleveland, Ohio, died October 23, 1945, aged 61 years.

Dr. Leonidas M. Stokes, Walterboro, South Carolina, died September 23, 1945, aged 66 years.

Dr. Otto H. Swantusch, Angola, Indiana, died October 13, 1945, aged 61 years.

Dr. Paul Tradelius, Brooklyn, New York, died October 11, 1945, aged 71 years.

Dr. John Walter Webb, Indianapolis, Indiana, died October 9, 1945, aged 64 years.

Dr. Clyde L. Welsh, Seattle, Washington, killed in action December 15, 1944, aged 45 years.

Dr. Albert A. Yungblut, Cincinnati, Ohio, died August 21, 1945, aged 73 years.

MISCELLANEOUS

PRECEPTORSHIPS

In regard to the substitution of a preceptorship for residency in an ophthalmic hospital, the American Board of Ophthalmology has always accepted such training in favorable cases. During the present overcrowding of facilities, the Board expects to take a liberal attitude regarding the requirements for training.

It should, however, be pointed out that neither a residency nor a preceptorship suffices in itself to meet the requirements of the Board. Each case will still be judged on its merits in determining fitness for examination.

In entering upon a preceptorship certain conditions should be kept in mind. First the student will profit most after a sound course in the basic sciences of physiology of the eye and of vision, optics, pathology, bacteriology, chemistry, pharmacology, the relation of the eye to general disease, anatomy, embryology, and neurology.

This is essential for a residency, more so for

a preceptorship. While men have been accepted from preceptors not diplomates of the Board, it is obvious that the Board has more information about those teachers who have passed its examinations.

Any preceptor should understand that he is assuming a responsibility in taking a student and is not merely obtaining help in the drudgery of his office. He should be willing to give time to clinical training and the use of apparatus, slitlamp, ophthalmoscope, tonometer, and to directing the student's practice in surgery on animal eyes, assisting in operations, and ultimately in performance of them.

To cover the same amount of ground will take much longer in a preceptorship than in a residency, and students should accept opportunities to take hospital positions of all sorts as they become available.

S. Judd Beach, M.D., Secretary.

Emory University will celebrate the one hundredth anniversary of the birth of Abner Well-born Callhoun, M.D., LL.D., born April 16, 1845, died August 21, 1910, the first professor of ophthalmology of the Atlanta Medical College.

You are cordially invited to be the guest of Emory University at an Ophthalmological Seminar to be held in Atlanta on April 4, 5, and 6, 1946.

PROGRAM

Thursday evening, April 4, 1946, ACADEMY OF MEDICINE. 6:30: Buffet supper; 7:30: Dr. James Edgar Paullin, "Dedication of Auditorium;" 8:00: Dr. Frank B. Walsh, "Myasthenia gravis;" 9:00: Dr. Walter I. Lillie, "Medical ophthalmology."

Friday morning, April 5, 1946, GRADY HOSPITAL. 10:00: Dr. Walter I. Lillie, "Diplopia;" 11:00: Dr. William Benedict, "The clinical meaning of exophthalmos." Luncheon (Guest of Grady Hospital).

Friday afternoon, ACADEMY OF MEDICINE. 3:00: Dr. Derrick Vail, "Eye changes in diabetes;" 4:00: Dr. Frank B. Walsh, "Naso-pharyngeal tumors;" 6:30: Dinner, Biltmore Hotel (Guest of Emory University).

Friday evening, ACADEMY OF MEDICINE. 8:00: Dr. Parker Heath, "Ocular therapeutics in glaucoma;" 9:00: Dr. John Dunnington, "Treatment of detachment of the retina."

Saturday morning, April 6, 1946, ACADEMY OF MEDICINE. 10:00: Dr. William Benedict, "Glaucoma in diabetes;" 11:00: Dr. John Dunnington, "Surgical treatment of the vertical deviations." Luncheon, Biltmore Hotel (Guest of Department of Ophthalmology).

Saturday afternoon, ACADEMY OF MEDICINE. 2:30: Dr. Parker Heath, "Random notes on ocular surgery;" 3:30: Dr. Frank B. Walsh, "Ocular signs of subdural hematoma;" 4:30: Dr. Walter I. Lillie, "The clinical diagnosis of retrobulbar neuritis."

Saturday evening, ACADEMY OF MEDICINE. 8:00: Dr. William Benedict, "Preparation of the patient for

cataract operation;" 9:00: Dr. Derrick Vail, "The circulation of the optic nerve and its influence on disease." Dr. Eugene Stead, Dean, 50 Armstrong Street, S.E., Atlanta, Georgia.

The University of Glasgow, Department of Ophthalmology, announces the following series of spring meetings:

During April and May a series of meetings will be held in the Department on Wednesdays at 8:00 p.m. The general arrangements will be similar to the series held last year. Tea will be served after the paper and a discussion will follow. The meetings will be open to all medical practitioners and senior students interested in Ophthalmology.

April 3d, "Industrial ophthalmology," by Prof. W. J. B. Riddell.

April 10th, "Keratoconjunctivitis," by Dr. I. C. Michaelson.

April 17th, "Concussion injuries of the retina," by Dr. A. M. Wright Thomson.

April 24th, "Ocular tuberculosis," by Professor Lowenstein.

May 1st, "Ocular vitamin deficiency," by Dr. J. D. Fraser.

May 8th, "Capillary fragility," by Dr. H. N. Munro.

All cases of legal blindness in New York State must be reported to the Commission for the Blind of the State Department of Social Welfare in accordance with a recent amendment to the act creating the New York State Commission for the Blind. It is now the duty of every health and social agency, attending or consulting physician, or nurse to report to the State Commission for the Blind, in writing, the name, age, and residence of persons who are blind within the definition of blindness and to furnish such additional information as the Commission shall request for registration or prevention of blindness.

This law supplements the mandated responsibility of the Commission for the Blind, Section 8774, Title 24, Chapter 3 of the Unconsolidated Laws to maintain a complete register of the blind in the State of New York which shall describe the conditions, cause of blindness, capacity for education, and industrial training of each, with such other facts as may seem to the Commission to be of value.

Data as required by the Commission for the Blind will further the State's effort to prevent blindness through a comprehensive knowledge of the facts relative to the causes of blindness. This information will also aid in the earlier recognition and detection of cases where remedial measures for restoration of vision are still possible. Likewise, those who may desire the services of the Commission for the Blind will be benefited through acquaintance with the opportunities available to which they are entitled.

Legal blindness is defined as total blindness or impaired vision of not more than 20/200 visual acuity in the better eye and for whom a diagnosis and medical findings show that vision cannot be improved to better than 20/200; or who has loss of vision due wholly or in part to impairment of field vision or to other factors which affect the usefulness of vision to a like degree.

Apparent blindness should also be reported even though not based on an eye examination.

For reporting blanks, please address the Commission for the Blind, 205 East 42d Street, New York 17, New York.

The following resident lectures in ophthalmology were held in New York City in February, 1946: at the Manhattan Eye, Ear, and Throat Hospital on February 1st and 8th: "Sulfonamides in ophthalmology," by Dr. L. Von Sallmann; "Allergy in ophthalmology," by Dr. Robert Cooke. At the New York Hospital on February 15th and 22d: "Syphilis of the eye and its treatment," by Dr. Walsh McDermott; "Local anesthesia in ophthalmology," by Dr. Walter S. Atkinson.

AMERICAN ORTHOPTIC COUNCIL

Examinations for Technicians

The next examination by the American Orthoptic Council will be held in September-October, 1946.

The written examinations will be held at various cities in the country on Friday, September 6, 1946. Only those passing the written examinations will be permitted to take the oral and practical tests, to be given in Chicago, Saturday, October 12, 1946.

Applications on official forms must be received before July 1, 1946.

Address the American Orthoptic Council, 23 East 79th Street, New York 21, New York.

It has been announced recently that the Helen Keller Committee on the Deaf-Blind has been formed as a department of the American Foundation for the Blind, 15 West 16th Street, New York 11, New York. The committee has the following objectives: (1) To improve educational methods for the deaf-blind on an individual basis to provide greater self-resourcefulness, thus compensating for limited contacts with others. (2) To find a shorter and more rapid manual language to speed communication with family and friends. (3) To obtain greater vocational opportunities for the deaf-blind in workshops for the blind and in private industry. (4) To increase the social relationships of the deaf-blind by developing special activities for them and by devising ways to permit them to participate in usual recreations.

SOCIETIES

The annual two-day meeting of the Pennsylvania Academy of Ophthalmology and Otolaryngology will be held at the Merion Golf Club outside of Philadelphia on Wednesday and Thursday, April 24 and 25, 1946. For detailed information address: Dr. Paul C. Craig, 232 North Fifth Street, Reading, Pennsylvania.

PERSONALS

Dr. Brittain Ford Payne has resumed the practice of ophthalmology, by appointment, at 17 East 72d Street, New York 21, New York.
- Dr. L. Conner Moss announces the reopening of his office at 1705 Rhode Island Avenue,

N.W., Washington, D.C., specializing in ophthalmology.

Drs. Trygve Gundersen and Joseph M. Clough announce their return to the practice of ophthalmology at 101 Bay State Road, Boston 15, Massachusetts.

Dr. Arthur M. Culler announces his return to the private practice of ophthalmology in the offices formerly occupied by Dr. Albert D. Frost at 150 East Broad Street, Columbus 15, Ohio.

Dr. M. W. Nugent has returned to the private practice of ophthalmology at 1930 Wilshire Boulevard, Los Angeles 5, California.

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RELATION OF THE EYE TO IMMUNITY IN SYPHILIS, WITH
SPECIAL REFERENCE TO THE PATHOGENESIS OF
INTERSTITIAL KERATITIS*

ALAN C. WOODS, M.D., AND ALAN M. CHESNEY, M.D.

Baltimore, Maryland

In the course of a long-term study of the general problem of immunity in experimental syphilis by one of us (A. M. C.), a detailed study of the role of the eye, and especially of the cornea, in immunity to syphilitic infection was undertaken. This investigation appeared pertinent because the older literature on this subject consists of reports of experiments which were carried out at a time when our information concerning the development of immunity in syphilis was fragmentary, particularly in relation to the time required for its development, and which therefore lack data essential to their proper interpretation. For this reason the problem was reinvestigated in the light of what is now known of the development of acquired immunity to syphilitic infection. The results of these investigations have all been reported in detail elsewhere and the literature on the subject reviewed.^{1, 2, 3} However, since certain points were uncovered by these experiments which may be of especial interest to ophthalmologists, and which may cast some light on the pathogenesis and certain clinical characteristics of interstitial keratitis, these experiments are again reported here in summary and their possible relation to interstitial keratitis is discussed.

The whole subject of immunity in syph-

ilis has been reviewed by one of us elsewhere⁴ and need not be discussed at length in this communication, but perhaps a brief summary of the present status of our knowledge in this field may be pertinent in the present discussion.

It is generally recognized that a rabbit infected with syphilis by intracutaneous or intratesticular inoculation gradually acquires a resistance against a second infection with the homologous strain of treponemes. This resistance is imparted to the skin and to the testis not previously inoculated. It is therefore a general or systemic immunity, and is effective against really massive doses of the homologous strain of organisms. It is somewhat slow in developing but is firmly established by the end of the third month after inoculation. If treatment with arsphenamine is given early in the course of the infection and in amounts sufficient to eliminate it, the development of immunity is interfered with, but if treatment is postponed until after the third month—that is, until after the immunity to the homologous strain of treponemes has been established—the immunity persists for an indeterminate period even if the animal is given amounts of arsphenamine sufficient to eliminate the original infection. In other words the immunity does

* From the Wilmer Ophthalmological Institute and the Syphilis Division of the Medical Clinics, the Johns Hopkins University and Hospital. This paper was prepared for the 1945 meeting of the Association for Research in Ophthalmology which meeting was cancelled. The paper was delivered in January, 1946, before the Research Study Club at Los Angeles, California.

not appear to be due to a continuing first infection, as some have supposed, but continues to be present in the absence of infection.

The mechanism of this immunity is not clearly understood. It was formerly thought to be cellular in character largely because of the difficulty in demonstrating protective antibodies in the circulating blood, but more recently evidence has been accumulating which indicates that a humoral factor is involved,⁵⁻¹⁰ and this factor may well prove to be the paramount if not the only factor.

The extent to which the eye shares in the development of the immune state during the course of syphilitic infection was the principal theme of our investigations. As has been stated, this question had previously engaged the attention of others, but an examination of the older literature revealed gaps in the experimental data which made it difficult to interpret many of the experiments, so that in the end one was left with too few experiments and too few animals upon which to formulate an altogether satisfactory answer to the question. For a review of this older literature, the reader is referred to our previous papers.

The experiments here reported in summary were carried out over a period of years, and not concurrently, because of lack of sufficient cage space for the experimental animals.

The specific questions which we have investigated are as follows:

I. To what extent does the cornea participate in the general resistance which develops during the course of a syphilitic infection?

II. Does a primary syphilitic infection in the cornea give rise to a general systemic infection, and does it impart to the other tissues of the body the same resistance to reinfection which develops when the primary focus is located in other tissues?

III. Does a local syphilitic infection in the cornea produce a local immunity of the cornea to reinfection?

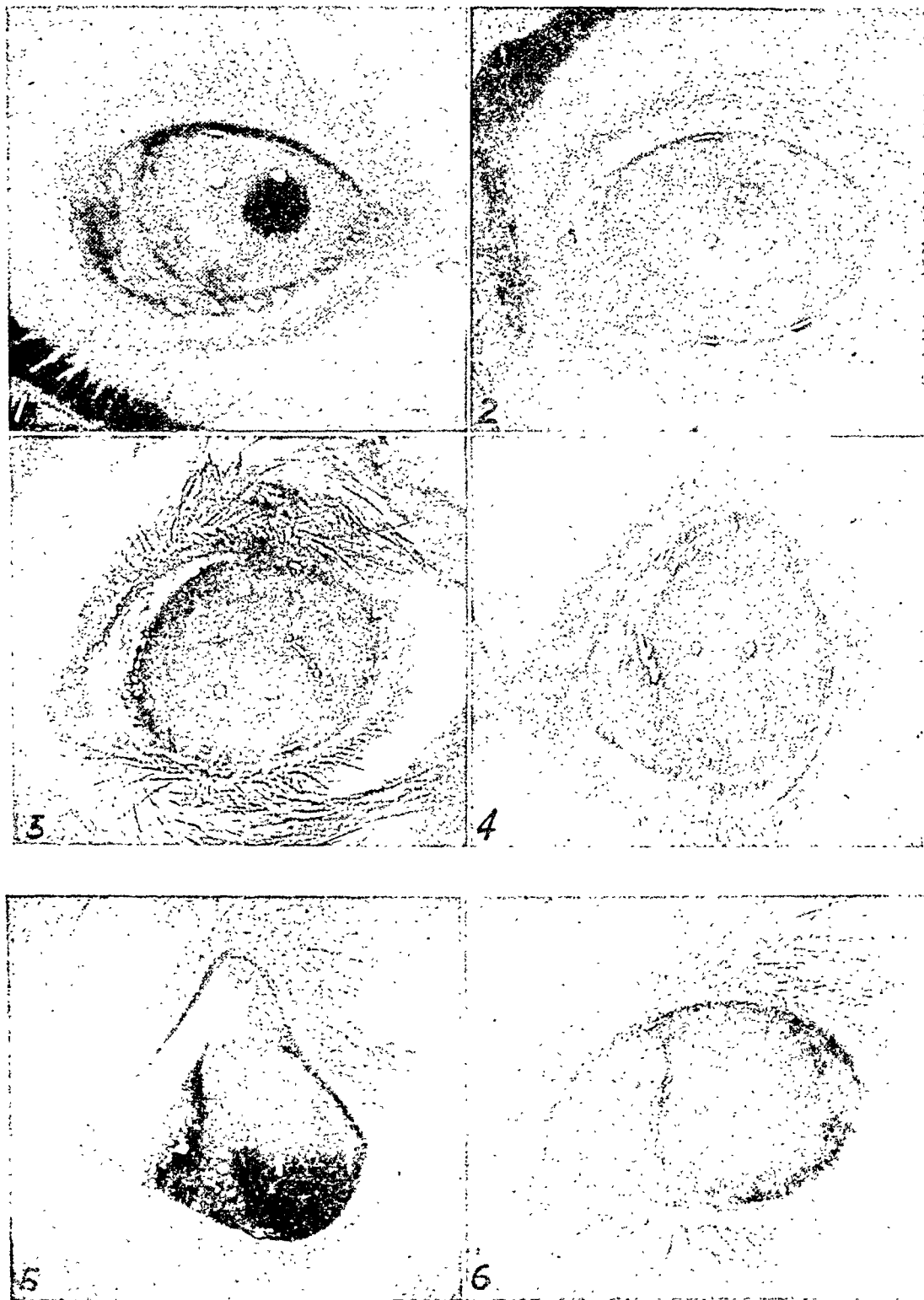
IV. Having determined that the cornea does not regularly participate in the immunity that follows a systemic syphilitic infection, the following question was investigated: Is the local avascularity of the cornea responsible for the failure of that structure to become immune during the course of a syphilitic infection produced by inoculation elsewhere than in the cornea?

TECHNIQUE

The technique of the various experiments performed in the investigation of these four questions has been reported in detail in our previous papers. The number of test rabbits used in each experiment varied from a minimum of 12 to a maximum of 35. For every test animal used, one control animal was inoculated in order that the test and control groups would be strictly comparable. The Nichols strain of treponemes was used in all experiments. After the primary inoculation, a sufficient time was allowed for the inoculated animals to develop a full immunity before treatment with arsphenamine was begun, the time between primary inoculation with treponemes and the first arsphenamine treatment being from 163 to 217 days in the different experiments.

All ocular inoculations were intralaminar injections of the cornea with the exception of one series inoculated in the anterior chamber. The pattern of ocular reaction which followed these injections was the same in both the reacting immune rabbits and in nonimmune controls, differing in the different series of rabbits only in the length of the incubation period and the intensity of the ocular lesion. Four types of ocular reactions were noted.

The first of these, which occurred in



Figs. 1-6 (Woods and Chesney). Response of rabbit eye to inoculation with treponemes. Fig. 1, Early corneal infiltrate. Fig. 2, Spreading corneal infiltrate. Figs. 3 and 4, Experimental interstitial keratitis with vascularization. Fig. 5, Primary syphilitic nodule at limbus. Fig. 6, Primary syphilitic nodule in center of cornea.

about 40 percent of the injected rabbits, was a typical interstitial keratitis, beginning as small corneal infiltrates which often had no relation to the site of the corneal puncture. These infiltrates increased in size, coalesced, and the eye developed an ordinary syphilitic keratitis, with pericorneal congestion, vascularization of the cornea from both the super-



Fig. 7 (Woods and Chesney). Central interstitial clouding of cornea without ciliary congestion and slight vascularization.

ficial and deep loops, and an associated iritis. Clearing of the corneal infiltration began with the completion of the vascularization phase (figs. 1, 2, 3, 4).

The second type of reaction was distinguished by the early development of an elevated yellowish nodule at the limbus. This was accompanied by an inflammatory reaction and followed by the development of an interstitial keratitis similar to that already described. This primary nodule was observed in about 50 percent of the reacting rabbits (fig. 5).

The third type of reaction was similar to the second type with the exception that the primary nodule occurred in the center of the cornea (fig. 6). This produced a weakness of the corneal parenchyma and usually resulted in a corneal ectasia.

The last type of reaction was peculiar. It consisted in a deep, gradually developing, central cloud in the cornea, with a remarkable absence of both ciliary congestion and corneal vascularization. It was comparatively rare, being observed in slightly less than 3 percent of the injected animals (fig. 7).

RESULTS

I. The first question—To what extent does the cornea participate in the general resistance which develops in the course of a syphilitic infection?—was investigated in three different experiments. The general plan of the experiments was as follows: The test rabbits were inoculated intratesticularly or intracutaneously, and the resulting syphilitic infection allowed to run its course until full immunity had presumably developed. They were then treated with arsphenamine and after the completion of treatment were reinoculated in the eye (either in the cornea or in the anterior chamber). In one series the rabbits were simultaneously reinoculated in the skin of the shaved back. At the time the immune test rabbits were reinoculated, an equal number of normal rabbits were similarly inoculated as controls.

Altogether 43 presumably immune rabbits were tested in these three experiments. In 27 of them, or 62 percent, syphilitic keratitis developed after reinoculation in the eye, whereas it developed in 39 or 91 percent of the 43 normal control animals. It is clear from these results that whereas the eye does share in the immunity that develops during the course of a syphilitic infection, it does not do so to the same extent as do other tissues (skin, testis). This state of affairs was clearly brought out in one of the experiments in which both the cornea and the skin of the immune animals were reinoculated at the same time with the same virus. In this experiment the skin

proved to be completely refractory in every instance, whereas in 9 of the 14 animals the cornea was found to be susceptible to a second inoculation.

The first question can therefore be answered as follows: The cornea of a syphilitic rabbit sometimes participates in the general resistance to reinfection that develops in the other body tissues as a result of the syphilitic infection, but in the majority of instances, in our experience, it does not.

II. The second question—(a) Does a primary syphilitic infection in the cornea give rise to a general systemic infection? and (b) Does it impart to the other tissues of the body the same resistance to reinfection that develops when the primary focus is located in other tissues?—was investigated in two experiments.

It was found first of all that syphilitic virus does not remain localized in the cornea after intracorneal inoculation but that the treponemes regularly make their way into the circulating blood and can be recovered from distant lymph nodes in practically every instance. In this respect the situation is identical with that which obtains after intratesticular or intracutaneous inoculation. Secondly, it was found that a high proportion of the animals inoculated intracorneally—19 in 33, or 56 percent—became completely refractory to a second inoculation with syphilitic virus introduced into the skin. Of the remaining 14 animals, 8 showed a partial skin immunity and only 6 failed to show any evidence of immunity at all.

The answer to the second question, then, is as follows: (a) Primary syphilitic disease of the eye in the rabbit is followed by systemic syphilitic infection. (b) It is also followed, in the majority of instances, by the development in the skin of a considerable degree of resistance toward reinfection with the homologous virus but not so frequently as after intratesticular or intracutaneous inoculation.

The reason for this failure of skin immunity to develop in all animals after intracorneal inoculation is not clear.

III. The third question—Does a local syphilitic infection of the cornea produce a local immunity of the cornea to reinfection?—was explored as follows: Rabbits were inoculated in the cornea with syphilitic virus, the ensuing keratitis was allowed to run its course, and after a proper interval had elapsed for the animals to develop the usual immunity to reinfection they were treated with arsphenamine. After the completion of the arsphenamine treatment, the rabbits were reinoculated in the same cornea with the homologous syphilitic virus. The period between the primary and the secondary inoculation in these animals was approximately one year. The corneal vascularization incidental to the primary inoculation had largely undergone atresia in this period.

The results were as follows: Of 33 test animals, 25, or 76 percent, were found to be completely refractory to the second inoculation of the same cornea with homologous syphilitic virus, whereas 8, or 24 percent, developed a delayed second attack of interstitial keratitis, the average incubation period in the 8 reacting rabbits being 109 days against an average incubation period of 37 days in the controls. Thus, a high proportion of the rabbits showed a completely refractory state in the same cornea one year after the primary inoculation. The long incubation period in the eight rabbits which finally reacted may be evidence of either a partial or a fading immunity.

IV. An answer to the fourth and final question—Is the avascularity of the cornea responsible for the failure of that structure to become immune during the course of a syphilitic infection produced by inoculation elsewhere than in the cornea?—was sought in the following manner: Syphilitic rabbits inoculated origi-

nally in the testis were treated with arsenamine at a time when they would presumably have acquired an immunity against a second infection with homologous syphilitic virus. One cornea of each of these immune rabbits was then injected with an emulsion of killed tubercle bacilli in order to produce a nonspecific keratitis. The lesion was usually interstitial in type but occasionally ulcerative. In every instance it gave rise to a heavy vascularization of the cornea, from both the deep and the superficial loops of the blood vessels. After the acute inflammation had subsided and any ulcers present had healed, but before the vascularization had completely regressed, both corneas of these animals—that is, the artificially vascularized and the normal corneas—were inoculated with homologous syphilitic virus. These corneal inoculations were made 35 and 47 days after the injection of the tubercle bacilli. As controls, normal rabbits with similarly vascularized corneas were inoculated at the same time with the same batch of virus.

The experiment was carried out twice, and the results were essentially the same in each experiment. In every instance the artificially vascularized eyes of the immune rabbits were completely refractory to reinoculation. The result was not entirely conclusive because the group of test rabbits showed a high degree of immunity in the nonvascularized eyes. However, the experiments did indicate that rendering the corneas of syphilis-immune rabbits vascular by producing in them a nonspecific inflammatory reaction tends to make the corneas more refractory to a second syphilitic infection. This tendency may be due to an increased exposure to circulating syphilitic antibody brought about by the artificial vascularity of the cornea.

The answer to the fourth question therefore appears to be that the avascu-

larity of the cornea is a factor in the failure of the cornea to become immune during the course of a systemic syphilitic infection, and that vascularization of the cornea influences favorably the development of local resistance.

DISCUSSION

The experiments summarized in this paper indicate, in brief, that: (a) the cornea does not always share in the immunity to reinfection which develops during the course of an experimental syphilitic infection in rabbits; (b) direct inoculation of the cornea with treponemes is followed by the development in that tissue of a local resistant state toward those organisms, although in some cases the protection thus conferred is either not absolute or not permanent; and (c) vascularization of the cornea appears to be a factor in influencing favorably the development of a local resistant state.

Do these findings throw any light upon the pathogenesis of interstitial keratitis, or offer an explanation for the well-known facts: (a) that this condition is a comparatively late manifestation of congenital syphilis and is rarely found in the acquired form of the disease? (b) that it is usually refractory to the conventional forms of antisiphilitic treatment? and (c) that it has a marked tendency to recur?

Several different theories have been advanced to explain the pathogenesis of interstitial keratitis. Chief among them are (a) the trophic-disturbance theory, (b) the traumatic theory, (c) the allergic theory, and (d) the vitamin-deficiency theory.

The trophic-disturbance theory would explain interstitial keratitis on the basis of a presumed local nutritional deficiency due to blocking by syphilitic inflammatory tissue of the long ciliary arteries and perivascular lymphatics in the region of

the limbus (Wagenmann 1890,¹¹ van Michel 1881,¹² Loewenstein 1927¹³ and 1929¹⁴). It presupposes the presence of treponemes in the inflammatory process.

The traumatic theory, as the name implies, takes the ground that trauma—such as rubbing of the eyes, eye strain, foreign bodies, and infections—is the precipitating agent (Spicer,¹⁵ Butler,¹⁶ Klauder,¹⁷ and others). Here, again, the actual presence of treponemes in the cornea is postulated.

The allergic theory holds that interstitial keratitis represents an allergic reaction in the cornea due to a sensitization of that tissue in fetal or early life by the syphilitic virus, and intoxication of it in later life by the treponemes or their products (Igersheimer,¹⁸ Derby and Walker¹⁹). This theory presupposes that either the treponemes or their products invade the cornea a second time.

The vitamin-deficiency theory, as the name indicates, holds that the lesions are due to a lack of certain vitamins, particularly riboflavin (Kruse, *et al.*)²⁰

No one of these mechanisms may be said to have been established as the cause of interstitial keratitis. Three of the four theories, however, require the presence of treponemes or their products in or about the corneal lesion.

The fact that treponemes have been found in the corneas of patients with active interstitial keratitis (Igersheimer,¹⁸ Clausen,²¹ Weve²²), and are also present in the corneas of syphilitic rabbits that show a metastatic keratitis, strongly suggests that the lesion of interstitial keratitis is an inflammatory process due to the presence in the cornea of the treponemes themselves, and makes it unnecessary to assume a nutritional deficiency due to a disturbance of circulation, or a lack of any vitamin, or an allergic process precipitated by treponemal products, in order to explain the occurrence of the lesion.

If the lesions of interstitial keratitis do not represent allergic phenomena or nutritional deficiency, but are simply inflammatory reactions occasioned by the local invasion and growth of treponemes, they are then part and parcel of an infectious process. On this basis the factors of local invasion and specific immunity, engendered by the infection itself and representing the host's local or general reaction to the invading organisms, each play a role in the pathogenesis of the lesions, and may also be responsible for any peculiarities which they exhibit. Therefore it is logical to examine the factors of local tissue invasion and specific immunity in relation to the cornea, from the standpoint of what is generally known about syphilitic infection and from the standpoint of our own experiments as well.

As concerns the question of local invasion, the precise extent to which treponemes lodge in the corneas of congenitally syphilitic children both before and after birth is, of course, not known. There is certainly, however, a wide dissemination of the organisms throughout the body in the early stages of both congenital and acquired syphilis, and there is evidence that some of the treponemes do reach the eye in congenital syphilis during the period of dissemination. Histologic examinations of the eyes of syphilitic fetuses and of stillborn syphilitic infants have shown, first, that a large percentage of such eyes show minor syphilitic lesions throughout the iris and choroid (Yoshida,²³ Rumbaur,²⁴ Friedenwald²⁵), and second, that treponemes are widely disseminated throughout the uveal tract (Bab,²⁶ Waetzold²⁷). Treponemes have also been demonstrated in the corneas of such eyes (Stock,²⁸ Bab,²⁶ Waetzold,²⁷ Schlimpert,²⁹ and von Hippel³⁰), although probably not in as great numbers as in the uveal tract. However, clinically recognizable lesions are extreme-

ly rare either in the cornea or iris in the early stages of congenital syphilis. Why do the treponemes which lodge in the eye not produce clinically recognizable lesions? Is it because (a) the human cornea, whether young or adult, does not constitute a favorable site for the multiplication of treponemes? or (b) is it because the cornea acquires fairly early a specific immunity, engendered, perhaps, by syphilitic lesions elsewhere?

In regard to the first of these possibilities it may be pointed out that not all tissues of the body offer favorable sites for the growth of treponemes and the development of syphilitic lesions. Thus it has been shown that treponemes can be recovered from the spinal fluid of patients with early syphilis in a fair (15 to 20 percent) proportion of the cases although there is no clinical evidence of neuraxis involvement in them, and the spinal fluid itself shows no abnormalities. In spite of this apparently frequent invasion of the human central nervous system by treponemes early in the course of acquired syphilis, the incidence of actual syphilitic disease of that system is much less than the incidence of invasion. It is possible that the cornea of infants may also be an unfavorable environment for the development of syphilitic lesions. Whatever may be the situation with the very young human cornea, the rabbit's cornea is a favorable site for the growth of treponemes, for keratitis is one of the commonest of metastatic lesions following intratesticular inoculation of that animal with syphilitic virus, and direct inoculation of the cornea also produces lesions in the majority of instances.

In regard to the second possibility—namely, that the cornea may acquire a specific immunity fairly early in the course of syphilitic infection—it may be recalled that Brown and Pearce²¹ noted

that lesions of the eyes were the last of the metastatic lesions to occur in experimental syphilis in rabbits, and usually developed in animals that had not had generalized lesions of other tissues (skin, bones). They thought that the occurrence of lesions elsewhere in the body protected the eyes from the development of syphilitic lesions in those organs. According to their view, the reactions of other tissues to the syphilitic virus can confer, or help to confer, upon the rabbit's cornea a specific resistance to syphilitic infection, and it may be presumed that if the reactions in other tissues are less marked or absent, then the resistance imparted to the cornea is correspondingly less or may be completely lacking. As a result of this diminution or absence of immunity, lesions might well develop in the cornea. Our own experiments have shown that while the cornea sometimes shares in the immune process it does not regularly do so under the conditions of our experiments. However, in those experiments the corneal tissue was subjected to a very severe test for immunity. Large doses of highly virulent treponemes were injected in the supposedly immune animals, and it is possible that more evidence of immunity would have been obtained had the test inoculum been smaller.

It seems reasonable to suppose that the comparative absence of lesions of interstitial keratitis in the early years of congenital syphilis, and also during the course of acquired syphilis, may be based upon the presence of acquired resistance in the cornea sufficient to prevent the growth of treponemes in that tissue. Can this conception, which is essentially immunologic in character, be invoked to explain the fact that interstitial keratitis is almost always a late lesion of congenital syphilis, occurring very rarely in the first years of life and most frequently between the ages

of 8 and 15, the peak of incidence being reached in the eleventh year? The answer is that such an immunologic conception will explain the late incidence of the disease if we assume that the immunity which the cornea acquires is not necessarily permanent but may subside with time. This is a reasonable assumption and is in accord with our own experiments. If the corneal immunity does subside and a syphilitic lesion develops in the cornea then the question arises whether the treponemes causing the lesion have been lying dormant in that tissue for years or have lodged there recently during the course of a fresh dissemination by the blood stream. Nothing is known as to how long treponemes may remain viable but dormant in the cornea, or whether or not a new dissemination of those organisms occurs late in the course of congenital syphilis. In any event, if the occurrence of the keratitis of congenital syphilis is to be explained upon an immunologic basis, we must conclude that when the lesions develop the affected cornea has lost whatever immunity it may ever have possessed. And we must conclude also, on this basis, that any immunity which the adult human cornea acquires during the course of acquired syphilis is long lasting and of high degree, for it is well known that interstitial keratitis is a very rare manifestation of acquired syphilis.

The unknown factors in the situation, which make it difficult to round out the immunologic theory of the pathogenesis of interstitial keratitis, are the amount of time which is required for the development of corneal immunity in the syphilitic fetus or infant, and the extent of the syphilitic process, either in the cornea itself or in the other tissues, which is necessary to render the cornea immune. Our experiments have shown that some syphilitic rabbits acquire a corneal immunity to

syphilis within at least 163 days after the original inoculation and they may well acquire it even earlier, if one may judge by the time required for immunity to develop in the skin or testis. It is easily conceivable that the congenitally syphilitic infant may have had his syphilis *in utero* long enough to have acquired a corneal immunity. Moreover, it is possible that the subclinical lesions which have been found in the eyes of syphilitic fetuses and of stillborn syphilitic children may produce a sufficient degree of local immunity in the cornea to protect that tissue against the development of lesions for some time, even if the immunity is not great enough to kill off all of the treponemes causing the reaction. Our experiments have shown clearly that the cornea itself can become immune to syphilis after it is inoculated with treponemes and a lesion develops, even though other tissues in the same animal, such as the skin, may not become immune following a primary corneal inoculation.

The results of our experiments, therefore, together with what is now known concerning the local invasion of the treponemes in syphilis and the development of specific resistance against them, are entirely compatible with the conception that the interstitial keratitis of congenital syphilis is due to the actual presence of treponemes in the cornea plus a subsidence or lack of specific resistance in that tissue to the organisms. This may not be the entire story, however, for it is conceivable that trauma may also play a role in the development of the condition, as many ophthalmologists have urged.

The specific traumatic incidents which have been suggested as playing a role in the pathogenesis of interstitial keratitis are the continual rubbing of the eyes, with resultant hyperemia and conjunctivitis; the constant irritation associated

with eyestrain; the presence of foreign bodies; and minor infections. All of these common conditions will produce a superficial nonspecific inflammatory reaction of varying intensity which is frequent or constant in older children and not present usually in infants. Butler reported a history of preceding trauma in 20 percent of his studied cases. Whether the common traumatic incidents just referred to are sufficient to initiate the syphilitic process in the cornea cannot be stated categorically, but the association of syphilitic lesions, especially of the late gummatous variety, with trauma has long been known. Moreover, it has been demonstrated experimentally that a nonspecific inflammatory process resulting from trauma offers a favorable environment for the growth of syphilitic virus and the development of syphilitic lesions.³² In the experiments which we are reporting here in summary form, a nonspecific inflammatory reaction in the normal cornea, produced artificially, was found definitely to hasten and enhance the development of a syphilitic lesion in that tissue after the direct inoculation of syphilitic virus.

The manner in which trauma influences favorably the development of a syphilitic lesion is not clear, although it is probably directly related to the inflammatory reaction that is set at the site of the injury rather than to the injury itself. One of us (A. M. C.) has already suggested that the effect of the inflammatory reaction is to establish conditions which are favorable for the growth of the cells of the body and that these conditions also favor the growth of the treponemes.

Trauma, therefore, cannot be ruled out as a possible contributory factor in the causation of interstitial keratitis. However, when we hypothecate trauma as a possible precipitating factor, we do so with certain reservations. Our experiments

have indicated that in the syphilis-immune animal, trauma sufficiently severe to produce vascularization of the cornea does not enhance the liability of that structure to the development of syphilitic lesions but, on the contrary, renders it resistant to reinoculation with treponemes. Therefore, when we hypothecate trauma as a possible factor which would dispose the eye of a congenitally syphilitic child to the development of interstitial keratitis, we must assume that such trauma would be minor, resulting in congestion of the conjunctival and limbal vessels with secondary cellular changes, and be insufficient to produce corneal vascularization. This assumption appears to be in accord with the general clinical experience. On this basis—minor trauma plus a diminished local resistance—interstitial keratitis, and indeed many of the other lesions of late syphilis, can be explained.

In a chronic infection such as syphilis the development of a late lesion *ipso facto* indicates the inadequacy of the resistant state at the site where the lesion develops. If we follow the general assumption that in syphilis, as in other chronic infections, there develops a delicate balance between the host and the invading agent, so that the organism is not killed off altogether but remains alive in certain tissues, though dormant, then it is easy to imagine that this delicate equilibrium might be upset by (1) the subsidence of the host's specific resistance, or (2) by the development, through trauma or some other as yet unknown factor, of conditions which favor the growth of the treponemes *in situ*, or (3) by a combination of both factors. The result would be the tipping of the scales in favor of the invader with the development of lesions. This conception seems to us to offer the most satisfactory explanation for the occurrence of interstitial keratitis.

In relation to this immunologic theory, a word should be said about the allergic theory. It is true that the late gummatous lesions of syphilis are usually thought to be allergic in character. This view is based upon the extreme scarcity of treponemes in gummata, although the tissue reaction in such lesions is very extensive. To explain these facts it is supposed that the infected individual has become allergic, so that he reacts with a maximal response to a minimal stimulus. The lesions of interstitial keratitis may be allergic in origin, but it would be extremely difficult to prove the point. There are no reliable agents at the present time for testing human beings for allergy to syphilis. Moreover, nobody has ever made any animal allergic to treponemes or their products by any procedure whatsoever. We attempted to render the corneas of normal rabbits allergic to an emulsion of syphilitic-rabbit's testis containing large numbers of treponemes but failed completely to do so. In addition, there was no evidence that the corneas of the syphilis-immune rabbits were at all allergic to syphilitic virus inoculated in large amounts. There is, therefore, no direct supporting evidence for the view that interstitial keratitis is an allergic phenomenon.

There remains the question whether the two other particular characteristics of interstitial keratitis—namely, its refractoriness to treatment and its tendency to recur—can be explained upon the basis of the factors which we have been considering. It is well known that interstitial keratitis is refractory to the conventional forms of antisyphilitic treatment. This may be due in part to a relatively low concentration of arsphenamine in the avascular cornea as compared to other more vascular tissues, for recent experiences with penicillin indicate that when

that agent is brought to the cornea in high concentration by such a local procedure as iontophoresis, healing of the lesions of interstitial keratitis takes place rapidly and is accomplished without vascularization. However, it has long been recognized that as soon as vascularization of the cornea is well established or complete in cases of interstitial keratitis, rapid clearing of the infiltrate and subsidence of the inflammation ensues.

This occurs irrespective of the kind of treatment, and indeed without any treatment at all. In short, vascularization of the cornea *per se* makes that tissue an unfavorable environment for the continuation of a syphilitic lesion. Our experiments indicate that vascularization of the cornea in a syphilitic rabbit favors the development of a local resistant state in that tissue, and it seems more than probable that the development of such a local immunity, presumably through antibodies coming from the blood, is the reason for the prompt healing of the keratitis that takes place once vascularization is established in the congenitally syphilitic cornea, since healing may ensue in the absence of antisyphilitic agents, but not usually in the absence of vascularization. Failure of interstitial keratitis to yield promptly to antisyphilitic treatment, then, may be due primarily to lack of vascularity and concomitant low concentration of the treponemicidal drug, and healing of the lesion in the absence of antisyphilitic drugs may be due to an increase in specific local resistance produced by vascularization.

The tendency of interstitial keratitis to recur is well known. Numerous studies of the effect of antisyphilitic treatment upon this condition indicate that in untreated or partially treated cases the incidence of recurrence may be as high as 27 percent, whereas in well treated cases

it may be as low as 2 percent. If the assumption that the healing of the lesions of keratitis is due largely or in part to the development of a local immunity coincident with vascularization of the cornea is correct, then, in order to explain the high incidence of recurrences in inadequately treated cases where the treponemes have obviously not been destroyed, it is necessary to assume that the local immunity is transitory and not permanent. Such a diminishing local immunity, plus the ever-present factor of minor trauma, would readily account for the high incidence of local recurrence in untreated cases.

Our experiments give no convincing data upon the duration of local immunity, once it is established. The data we can offer in this connection are scarcely suggestive. Of 33 rabbits which were inoculated originally in the cornea and in which the syphilitic lesions became vascularized and healed prior to treatment with arsphenamine, 25, or 76 percent, were totally immune to a second inoculation with the homologous strain of treponemes carried out about a year after the onset of vascularization. The remaining eight reacted with lesions in the cornea but after a very long incubation period. These eight may have had only a partial immunity in the beginning which faded somewhat with time. It would require repeated corneal reinoculations in syphilitic rabbits to establish the point.

SUMMARY

A series of experiments is reported in summary, which indicates that: (a) the corneas of rabbits with experimental syphilis induced by intratesticular inoculation do not always share in the immunity to reinfection which develops during the course of the syphilitic infection; (b) direct inoculation of the cornea is followed by the development, in that tissue, of a local resistant state toward those organisms, although in some instances the protection thus conferred is either not absolute or is not permanent; (c) vascularization of the cornea appears to be a factor in influencing favorably the development of a local resistant state.

The bearing of these findings upon the pathogenesis of interstitial keratitis and upon other phenomena associated with this condition is discussed. It is suggested that the usual late occurrence of the lesions of interstitial keratitis may be due to a combination of lack of local immunity in the cornea in some cases of congenital syphilis, plus the occurrence of minor traumatic incidents as the initiating factor. The fact that the lesions of interstitial keratitis will heal spontaneously when vascularization occurs may be explained upon the basis of the development of a local immunity, presumably through antibodies coming from the blood. The tendency of the lesions of interstitial keratitis to recur may be related to the fading of a local immunity.

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ATOPIC CATARACTS*

REPORT OF FOUR CASES

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That there is a definite relationship between various types of dermatitis and cataract formation has been recognized for some time. In 1868 Rothmund¹ reported on the association of juvenile cataract with an unusual type of dermatosis. The condition did not appear in the American literature, however, until 1921, when Davis² reported the case of a girl, aged 15 years, with neurodermatitis, who developed cataracts that matured in one year. Since that time an increasing number have been reported. Daniel³ reported three cases in 1935, Brunsting⁴ 10 cases, including Daniel's cases, Beetham⁵ 10 cases in 1940, and McDannald⁶ two cases in 1943. Bellows⁷ in 1944 stated that up to that time over 40 cases had been reported in the literature and added that undoubtedly many more cases have been observed since the condition is readily recognized by ophthalmologists.

Cataracts associated with dermatosis come under three main classifications: 1. neurodermatitis (Andogsky syndrome); 2. poikiloderma atrophicum vasculare (Rothmund's disease, Jacobi's disease); 3. scleroderma (Werner's disease). In addition Buschke⁸ points out that cataracts have been associated with keratosis follicularis (Darier's disease), telangiectasis, myxedema, and certain anomalies of the hair (curly hair; alopecia, and aplasia pilaris). Here we are concerned only with the cataract seen in association with neurodermatitis.

Neurodermatitis is characterized by

pruritus associated with lichenification and shows a typical distribution. It may be either exudative or dry. This latter type, in which cataract formation is seen, has been designated by Coca⁹ as *atopic dermatitis* and has resulted in these cataracts being called *atopic cataracts* in the American literature. Coca has classified allergic diseases under the following headings: (1) atopy (hay fever, asthma, and eczema), (2) contact dermatitis, (3) serum allergy, and (4) drug allergy.

Löwenstein¹⁰ and others have attempted to show that these cataracts are endocrine in origin, most likely on a basis of thyroid deficiency. Laboratory and clinical observation have, however, been disappointing. The name neurodermatitis has been applied because of the fact that these patients frequently have disturbances of the autonomic nervous system, together with the presence of nervous instability and exhaustion. Psychiatric maladjustment is also frequently present. As Bellows⁷ points out, the intense discomfort of neurodermatitis might explain the nervous instability. While there is still a good deal of discussion as to the cause of the dermatitis and the causative factors must still be considered unsettled, the tendency in this country is to accept the allergic theory, and the term atopic dermatitis.

Atopy is defined as the condition of being sensitive to an allergen. Coca⁹ has used the word atopy to express the unusual hereditary tendency of some individuals to develop severe reactions to certain common protein materials, the reaction being accompanied by hay fever, asthma, and eczema. Thus atopy implies

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the presence "in the serum of the circulating blood of atopens or reagins, known as Prausnitz-Küstner bodies."⁵ These reagins can be passively transferred to the normal skin of another individual, who will react to the specific antigen (Prausnitz-Küstner test).

According to Coca⁹ atopic dermatitis can be differentiated from other allergic manifestations of the skin by the following characteristics: (1) its familial tendency, (2) the allergins are antigens, (3) the formation of reagins (antibodies), (4) the skin test.

Sulzberger and Hill¹¹ are of the opinion that the atopic stigma is acquired during the embryonic life of the individual, by means of the passage of certain proteins through the intestinal digestion to the mother's blood and hence to the embryo without undergoing any alteration and provoking in the latter a specific reaginic reaction. The sensitivity continues through childhood and persists into adult life, tending to disappear in middle life.

During infancy the eczema is of the weeping, crusty type. During childhood a papular eruption is present, which may or may not be accompanied by asthma. In adult life the lesions consist of elevated papules and dry, scaly, lichenified plaques. These lesions may become secondarily infected, with oozing, weeping, and crust formation. The lesions, which are accompanied by intense pruritis, have a predilection for the antecubital and popliteal fossas, side of the neck, face, and forehead. At times there may be generalized involvement.

The course of the disease is chronic, with intervals of months or years between severe exacerbations. The condition is worse in cold weather. In some cases, as in our fourth case, a change of climate may be very beneficial.

Cataract formation as part of the pic-

ture in neurodermatitis was first described by Andogsky.¹² What is usually considered a typical form of atopic cataract is the formation of a white milky plaque in the pupillary area which may be localized in the region of either the anterior or posterior pole of the lens, involving the superficial layers of the lens cortex. Benedict¹³ observed that the early changes are granular deposits in the anterior capsule and an increase in prominence of the Y suture lines. The mature cataract appears gray or light cream in color. Beetham⁵ states that two types of cataract can be described, the first being the typical and commonly seen complicated cataract which begins at the posterior pole with increased iridescence, vacuoles, and precipitates. Striation of the lens fibers is often present as are small punctate opacities and iridescent crystals. These changes spread rapidly, involving the anterior cortex immediately beneath the lens capsule. The opacities then progress to a homogeneous mature cataract, the picture being that of the usual complicated cataract. The second type consists of a dense, irregular, opaque plaque in the pupillary area just beneath the anterior lens capsule. The capsule may be wrinkled or irregular but is essentially normal. Vogt¹⁴ refers to this type as the neurodermatitis cataract. Thirty to 50 percent are unilateral.

The incidence of cataract in atopic patients is unknown. The 10-percent incidence found by Brunsting⁴ in his series would indicate the possibility of a rather high occurrence. It would be interesting to conduct a survey of atopic patients to determine whether or not cataract formation is present in those who show no evidence of dermatitis. If cataracts were present only in the group that showed evidence of dermatitis, one would favor the theory that the lens opacities are the local manifestations of an ectodermal af-

fection. If present in atopics without dermatitis the condition would then be considered as part of a more generalized process.

The age at which the cataract makes its appearance is variable, with the highest incidence in puberty and young adult life. The patient reported by Davis² was 15 years old. Brunsting's⁴ series shows an average of 22 years, the youngest being 13 and the oldest 35. The average in Beecham's⁵ series was 22. McDannald's⁶ patients were 18 and 22 years old. Our patients were 18, 32, 49, and 21 years old. Our 49-year-old patient is the oldest to be reported. The previously oldest case to be reported was Olmann's¹⁵ 46-year-old man.

Sex has no apparent influence in the incidence of cataract in atopic dermatitis.

The mechanism of the formation of the lens opacities is uncertain. The theory that the lens opacities are the manifestation in the lens of an ectodermal disease is the most fascinating. This theory is supported by the fact that other dermatoses such as scleroderma and poikiloderma atrophicum may be accompanied by cataract formation. This theory, however, excludes the possibility of cataracts in atopics without dermatitis. On the other hand, as Vaughan¹⁶ has pointed out, each allergic patient has organs or tissues wherein his allergy is manifested which are called "shock organs" or "shock tissues." Such organs may or may not change with time and the allergens. Coca¹⁷ speaks of "atopic shock organs." He feels that the lesions of atopic hypersensitiveness are encountered in many parts of the body, and when they occur in special organs he refers to them as "shock organs." Thus the skin, conjunctiva, nasal mucous membrane, bronchi, gastrointestinal tract are recognized shock organs, and to these may be added perhaps the urinary bladder and the ret-

ina. Coca¹⁸ reports retinal edema associated with food allergy. Balyeat¹⁹ reported bilateral complete retinal detachment in a young woman of 21 years, who had an atopic dermatitis. She developed eczema at 3 months of age followed by asthma and hay fever when she was 12 months old. While the asthma gradually became less severe, the eczema slowly increased until at 16 years the eruption was marked about the face and chest. The patient first noted the visual disturbance when 17 years of age, when retinal detachment was diagnosed for the first time. The patient was found to be sensitive to a number of foods and inhalants. This report is of particular interest because of the retinal detachment in case 4 reported here.

With this conception one can easily understand how the lens, at times, may be the atopic shock organ and that any atopic patient, with or without dermatitis, may have lenticular opacities. The influence of vitamins and endocrine secretions is not clear in these cases. The part played by the nervous system cannot be evaluated, owing to the fact that it is difficult to determine whether the nervous upset is an etiologic factor or a consequence of the atopy. Alan Woods²⁰ believes that the lens capsule in these cases is damaged, permitting normal aqueous to enter the lens, thus producing an ordinary traumatic cataract.

The treatment of these cases is surgical. No difficulties are encountered, although Brunsting⁴ warns that, because of the tendency of the capsule to rupture, intracapsular extraction is more difficult. However, almost all of these patients fall in an age group wherein intracapsular extraction is not generally accepted as an advisable procedure. Bellows⁷ also states that because of the fact that sclerosis of the lens occurs early in these cases lineal extraction is frequently contraindicated.

REPORT OF CASES

Case 1. M. M. J., a white male, 15 years old, was seen in the outpatient department on October 20, 1944, complaining of loss of vision.

The father had had asthma for many years and one brother has hay fever. The patient's birth was normal. Between 6 months of age and 3½ years he had infantile eczema. At seven years he had asthmatic attacks that persisted for a short time. He was then free from symptoms until the age of 10, when he again developed attacks of asthma. One and a half years before entry he had a severe attack of asthma following a football game in which he participated. The next morning he noted red, moist, pruritic skin lesions on his face, arms, trunk, and legs that have persisted since that time.

Physical examination. Keloid scars were observed on the back and back of the legs as a result of burns as a child. The skin of the face and trunk as well as of the arms and legs showed a dermatitis with crusting and lichenification. There was eczema of the external auditory canal.

Ocular examination. Right Eye: External examination was negative. Slitlamp examination showed fine anterior subcapsular opacities with larger posterior subcapsular opacities with "cloth of gold" reflex. Both Y's were somewhat prominent. Vision 20/30—1, unimproved by lenses. The fundus was negative.

Left Eye: External examination was negative. The slitlamp disclosed very few fine anterior subcapsular opacities, with rather marked posterior opacification (subcapsular). Both Y's were prominent. The fundus was negative.

Nasal smear showed eosinophiles + + +. The blood count showed on eosinophilia of 11 percent.

Allergy tests. The patient proved to be allergic to pollens of various trees and

to some spring plants, but not to foods.

Case 2. G. M., a white man, 32 years old, reported to the outpatient department on December 4, 1944, because of progressive loss of vision.

No familial history of allergy was obtained. The patient had eczema at five years of age that cleared after a short time. He had no further difficulty until 1933, when he developed an eczema of the face, arms, and elbows that was severe for a time and then disappeared, only to reappear later. The intervals between attacks were a few days to a few months. He had received treatment for his atopic dermatitis in many parts of the country. In June of 1943 he noted blurred vision in his right eye, followed a little later with difficulty with his left eye.

Physical examination. The patient failed to return for general physical examination so that aside from the typical atopic dermatitis no data are available.

Ocular examination. Right Eye: The external examination was negative; the slitlamp showed rather well-advanced anterior and posterior subcapsular opacities. The fundus was grossly negative.

Left Eye: The external examination was negative; the slitlamp showed anterior and posterior subcapsular opacities similar to those seen in the right eye.

Case 3. L. L., a 49-year-old Chinese male, reported to the outpatient department on January 9, 1945, complaining of diminution of vision in his right eye, with right monocular diplopia.

A son and a daughter have rather severe hay fever. The patient has had severe itching of the face and hands since 1943, and has a generalized atopic dermatitis with induration, crusting, and lichenification. Leprosy was suspected, but a biopsy specimen was negative.

Physical examination. Aside from the

atopic dermatitis this was negative.

Ocular examination. Right Eye: Vision 20/70 was unimproved by lenses. Slit-lamp examination showed somewhat dense central posterior subcapsular cataract. Aside from this the examination was negative.

Left Eye: Vision was 20/30. External examination was negative. The slitlamp showed some diffuse fine dotlike white opacities throughout the lens. The fundus was negative.

Allergy tests revealed sensitivity to a number of pollens. The treatment prescribed on this basis has helped his general condition a good deal.

Case 4. (Most of the data in this case were kindly provided by Dr. L. L. Henry, of Pasadena, who has been watching the case.)

E. T., a white girl aged 17 years, was first seen on November 20, 1944, complaining of marked itching, tearing, and burning of the eyes after reading.

She had had a mild eczema of the face, wrists, and elbows since the age of three years. There was a history of asthma and hay fever. Tests showed an allergy to chocolate, fowl, and rabbit. Childhood illnesses, except for the allergies, were not unusual or significant. The patient was severely constipated and was using mineral oil and N-R tablets for relief of this. Menstrual history was negative. The genito-urinary system was negative except for an irritating leucorrhea. The heart and lung history was negative except for the asthma and three mild attacks of pneumonia.

Eye examination at this time was entirely negative except for a mild allergic conjunctivitis.

The patient was then sent to Arizona for two years where, according to her statement, she was entirely free from symptoms. As soon as she returned home her symptoms returned and she became

so ill that she was sent to a sanitarium.

When the patient was seen on April 19, 1944, the vision of the right eye was reduced to perception of fingers at one foot in the lower field; vision of the left eye was 20/100, unimproved by glasses. The patient stated that her vision had been failing during the last month. The dermatitis had been much worse, and she had been rubbing her eyes and slapping her face to allay the itching.

Examination at that time revealed a retinal detachment in the right eye in the superior and temporal quadrants, including the macula. The vitreous was cloudy. The left eye showed a definite edema of the entire retina. It was thought at this time that the detachment was due to allergy and edema and that it was similar to the detachment seen in pregnancy. The consultant at the time was of the opinion that the process was self-limited and that the retina would become reattached as the edema subsided.

Two months later, on June 20, 1944, examination revealed the retina in the right eye to be almost completely detached, except for a small area in the superior nasal quadrant. The vitreous was cloudy; the lens clear. The left eye still showed edema. The patient's general condition was such that operation could not be considered. On July 19, 1944, the right eye presented a dense cortical cataract. Only questionable light perception was present. In the left eye, at this time, the posterior cortical area showed early opacities; there were numerous fine vitreous opacities. The retina was more edematous.

The patient was last seen on November 27, 1944. She still had the typical atopic dermatitis. The cataract in the right eye was practically mature. The eye was amaurotic. The left eye had vision of 20/100, unimproved by glasses. Examination revealed a fairly dense posterior capsular cataract. The retina, seen with difficulty, was apparently still edematous. The

field was normal to large test objects. Tension was 20½ mm. Hg (Schiotz).

COMMENTS

Four cases of cataract formation in patients with atopic dermatitis are reported.

Two of the cases warrant special comment. In case 3 the skin condition had been diagnosed as possible leprosy until a biopsy specimen proved otherwise.

In case 4 there was the additional complication of retinal detachment in one eye with edema of the retina and a definite edema of the retina in the other eye. With a history of allergy, and an allergic conjunctivitis, it seems justifiable to attribute the edema and the detachment to allergy. The rubbing of the eyes and slapping of the face to allay the itching

may have been an additional factor in producing the detachment. This case we feel can be considered as adding evidence in favor of the allergy theory, particularly in view of Coca's report of retinal edema on an allergic basis and the case of bilateral retinal detachment associated with allergy, reported by Balyeat.

A brief résumé of the allergy theory has been given, in particular the theory of Coca, for which he coined the phrase atopy, because it would seem that cataract formation must be considered as an uncommon part of the syndrome. The theory of the atopic shock organ seems admissible.

Detailed ocular examination in all cases of atopic dermatitis seems to be warranted.

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THE SURGICAL TREATMENT OF STRABISMUS*

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Monocular vision with its attributes may well serve the individuals who do not know the transcendent quality of stereoscopic binocular single vision with spontaneous appreciation of form, speed, direction, and distance, the highest attributes of human eyes. The principles of the orthoptic and surgical treatment necessary for the development or restoration of binocular single vision involve a study of monocular vision and accommodation, the correspondence of images of the two eyes, convergence, divergence, the transmission, reception, fusion, and interpretation of the images of the two eyes, and a consideration of the factors which interfere with them.

NECESSARY ORTHOPTIC AND SURGICAL TREATMENT

After the factors have been considered and the data assembled that conduce to the development of an individual case of strabismus, one is in a better position to evaluate the orthoptic and surgical measures that may be necessary to correct the condition. Orthoptic exercises are desirable and in most cases necessary before and after surgery. The observations made during repeated orthoptic analyses help much in determining the course to be pursued and the type of surgery that is suited to the case. The parents and particularly the patient

should be convinced that the desirable objective is not simply a cosmetic result but a functional one as well. Every effort should be made to develop or restore monocular vision in each eye separately and then to remove the obstacles which hinder correct binocular vision. Anomalous correspondence may prove more of a stumbling block than that of the restoration of central vision of the deviating eye through prolonged and continuous occlusion of the dominant eye. If the eyes are not finally made to see "eye to eye," the gains made by occlusion may be lost as soon as the dominant eye is uncovered. The errors of refraction and aniseikonia as well as other factors should be corrected so that when normal correspondence and sufficient vision is developed in the deviating eye, the act of binocular vision may be maintained. The eyes should be given every opportunity to develop desire, amplitude, and strength of fusion to resist factors that tend to break it up. Excursive exercises of each eye separately and of both together into the planes of movement or action of the extrinsic ocular muscles are helpful in relieving spasm or weakness and reestablishing normal individual muscle tone. The ophthalmologist should make the analysis and diagnosis with or without the aid of an orthoptic technician, and he should supervise the actual carrying out of the exercises by a person who has the time and patience necessary to achieve the result. The technician should understand the case so that he or she may intelligently coöperate. It is unwise, however, for the technician to assume or be given complete charge of the patient. The coördination of such effort of

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the ophthalmologist and the orthoptist is for the welfare of the patient.

PRINCIPLES OF SURGERY IN CASES OF STRABISMUS

After a period of orthoptic training, satisfaction may have been found in complete correction of the heterotropia by various nonsurgical means. If this is not accomplished, the aid of surgery may be necessary to realign the eyes so that training for, and establishment of, binocular single vision are possible. On general principles, weakness of a muscle or associated muscles may be relieved by resection, advancement, or tucking of one or more muscles at their insertions, whereas spasm or overaction of a muscle or associated muscles may be relieved by tenotomy, myotomy, recession, or retroplacement of the muscle or muscles at their insertions. The inferior oblique is the one exception. It may be approached either at its origin or at its insertion. In actual practice, if one or more of the horizontal muscles are parietic and there exists overaction of their associates, the solution is through a conservative surgical procedure on one or both muscles as indicated. The full plan of operation cannot always be satisfactorily made before the operation. The condition of the muscles when exposed to direct view may determine the exact course of the surgery. In cases of horizontal strabismus, both the lateral and medial rectus muscles should be exposed and observed before the operation on either one of them is completed. Usually, it is best to expose first the muscle which is weak, then the overacting muscle; the conditions are evaluated, and the operation of recession of the overacting muscle, if necessary, is completed before resection of the weaker muscle is performed. Certainly, one should not fol-

low a routine of using one operation for all types of convergent or divergent strabismus, but should individualize and particularize in each case and apply the procedure in the measure that is suitable, purposely never doing too much. The surgeon should be content with an undercorrection that may be amenable to a further procedure rather than to accomplish too much and then find it difficult to reconstruct. He should be willing to operate on the fellow eye, when it is necessary, rather than try to correct a great degree of strabismus by an extensive operation on one eye; even to operate on the dominant eye in cases of monocular fixation, when the surgery on the deviating eye proves insufficient.

THE DECISION TO OPERATE

The decision to operate is made only after (1) complete cycloplegia with refraction, (2) observation of the effect of the correction of ametropia, (3) comparison of subjective and objective tests of vision, tests for correspondence, degree of fusion, rotation, monocular and binocular uncover tests in the primary position and in the six cardinal points of gaze, (4) occlusion of the fixating eye and the correction of amblyopia, if possible, (5) excursive exercises with both eyes open and also with one eye occluded, (6) development of normal correspondence, if possible, (7) fusional training. If all of these preliminaries have been tried and strabismus still exists after a reasonable period of endeavor, or if the deviation is such that fusion is impossible without cumbersome devices that can be applied only for a brief period of time, then surgery is indicated to correct the cosmetic blemish and to give the patient a chance to develop useful binocular vision in the improved position of the eyes.

SURGERY NECESSARY FOR THE CORRECTION OF STRABISMUS MAY WELL BE PERFORMED AT AN EARLY AGE

The time of operation is not governed by an age limit. No advantage is gained by delaying the operation until a child has attained a certain age for fear that the eye will deviate again in either the same or the opposite direction, or in the mistaken notion that the eyes or the muscles are insufficiently developed to permit satisfactory surgery.

Strabismus is a definite handicap to the young patient in developing his personality and aptitudes. From a purely psychologic viewpoint, early surgery is indicated, certainly before the school age of four to six years has been reached, and the child subjected to the taunts and unkind remarks of playmates who take particular delight in being cruel in this respect. The possibility of functional development is greater if conditions are remedied early before the growth or developmental stage is passed. The vocations open to the young person and the manner in which he may achieve success in them are far better if he has good central vision with fusion and stereopsis than if he has only one good eye and must orient himself by the application of the phenomena of parallax.

THE CONSERVATIVE APPROACH TO THE SURGICAL CORRECTION OF STRABISMUS

As has been stated, it is better to perform a conservative operation which may require further surgery at a later date than to do too much or operate on too many muscles at one time. This practice has been successful and has prevented overcorrections that are difficult to relieve. The effect of too much surgery is hard to estimate. It is desirable also to allow a suitable length of time to elapse between operations so that the tissues

may resolve and heal completely, and the capacity of the muscles be demonstrated in their new positions before a second operation is determined upon.

THE SURGICAL ARMAMENTARIUM FOR CASES OF STRABISMUS

Various operations have been developed and described as applicable to the correction of strabismus. I shall describe procedures and techniques that I have found most satisfactory and reliable for achieving good results in the correction of ocular deviations.

Tenotomy—freely applied to the lateral rectus, but only in guarded form to the medial rectus.

Myotomy—may be applied to the inferior oblique in certain cases of overaction.

Myectomy—applied in resection of rectus muscles and in cases of extreme spasms or overaction of the inferior oblique muscle.

Resection or Advancement or Tucking—applicable to any of the recti and to the inferior oblique.

Recession or Retroplacement—applicable to any of the rectus muscles and to the obliques.

PROCEDURES AND TECHNIQUES

TENOTOMY

This consists in free or partial division of a rectus muscle at its tendon insertion. It is applied to the lateral rectus muscle, as, for example, in case of divergence excess. A small incision is made through the conjunctiva overlying the tendon, the latter is isolated and freely divided at or near the insertion. No dissection of Tenon's capsule is made. Simple closure of the conjunctival incision with two plain gut 4-0 sutures is all that is needed. Tenotomy formerly applied in guarded or partial form to the

medial rectus muscle in cases of overaction has been replaced by the operation of recession or retroplacement. Tenotomy of the medial rectus muscle is undesirable because of the usual sequela of divergence and of the appearance of sinking of the caruncle. One can never be sure of the degree of effect of the guarded tenotomy, so for the purpose of the procedure it is better to perform a recession or retroplacement of the muscle.

MYOTOMY

Myotomy, or division of a muscle, is made use of in case of overaction of the inferior oblique. The muscle is severed at its origin at the inferior nasal margin of the orbit. The attachment of the muscle to its investing sheaths prevents its full retraction and permits its action and function to be preserved to a less degree than previously. Myotomy of the inferior oblique at its insertion, however, produces too great an effect, and results in its complete paralysis. Myotomy of a rectus muscle or division of the muscles well behind their tendinous insertions would, if practiced, probably produce a similar undesirable paralytic effect. It is not to be recommended.

Technique of myotomy of the inferior oblique muscle at its origin. An incision may be made through the skin at the inferior nasal margin of the orbit, cutting through the orbicularis and superficial fascia, then through the deep fascia, exposing the orbital contents. A muscle hook is inserted point down back along the floor of the orbit from a point just temporal to the origin of the inferior oblique. The point of the hook is then turned nasalward and placed beneath the insertion of the muscle. The muscle is brought into the section on the inner curve of the hook, is isolated from its investing sheaths, cut across near the

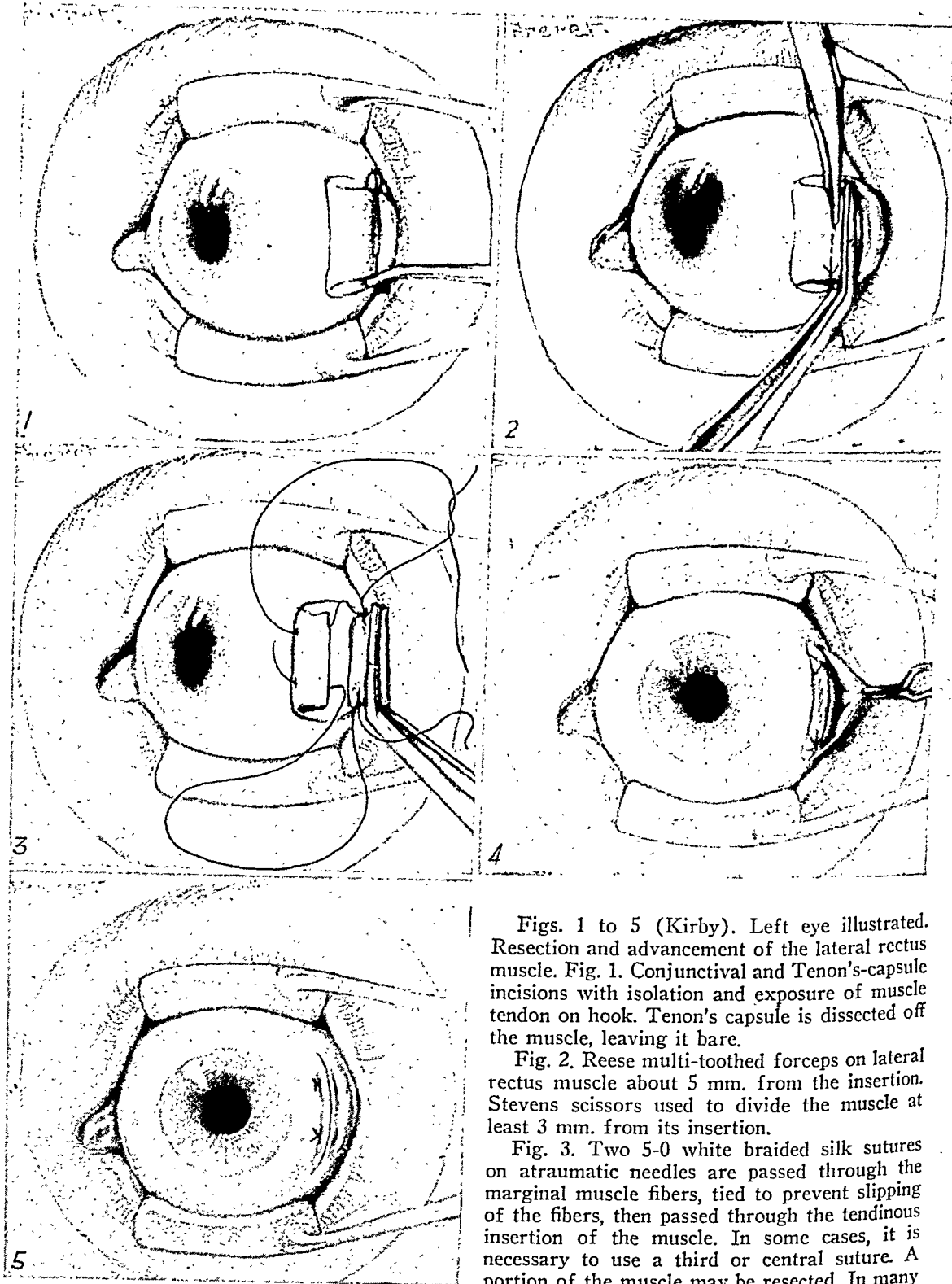
origin, and allowed to retract. The procedure may be varied by making the incision through the lower nasal conjunctival fornix, and exposing the muscle in much the same way as through the skin. For a more accurate or graduated effect in correcting the lesser degrees of overaction of the inferior oblique and for proper balance when both inferior obliques require less action, see the paragraph with the description of the technique of recession of the inferior oblique as developed by White.

MYECTOMY

Myectomy, or removal of a portion of muscle tissue, may be applied in cases of underaction, as, for example, when a portion of the lateral rectus muscle at its tendinous insertion is removed and the remainder is advanced and attached to the previous insertion. Myectomy may also be performed in case of an extremely overacting inferior oblique by removing a portion of the muscle at or near the insertion and allowing the rest of the muscle to retract into its investing fascias.

RESECTION—ADVANCEMENT—TUCKING

The principle of resection, or removal of a portion of a rectus muscle near its tendinous insertion, and advancement of the cut end of the muscle to be attached to the previous tendinous insertion may be applied for the correction of weakness of action of an individual muscle. Shortening the weakened muscle according to various methods of cinching may be used to increase the action and function of the muscle, but I have not often found it necessary to use these procedures. The technique of resection and advancement, which follows in the next paragraph, has well served the purpose. It may be applied to any of the rectus muscles as indicated.



Figs. 1 to 5 (Kirby). Left eye illustrated. Resection and advancement of the lateral rectus muscle. Fig. 1. Conjunctival and Tenon's-capsule incisions with isolation and exposure of muscle tendon on hook. Tenon's capsule is dissected off the muscle, leaving it bare.

Fig. 2. Reese multi-toothed forceps on lateral rectus muscle about 5 mm. from the insertion. Stevens scissors used to divide the muscle at least 3 mm. from its insertion.

Fig. 3. Two 5-0 white braided silk sutures on atraumatic needles are passed through the marginal muscle fibers, tied to prevent slipping of the fibers, then passed through the tendinous insertion of the muscle. In some cases, it is necessary to use a third or central suture. A portion of the muscle may be resected. In many cases, however, this is not necessary. Only the

muscle tissues, not the investing fascias, are included in the sutures.

Fig. 4. The muscle has been advanced and the sutures tied. Further dissection of the conjunctiva is unnecessary.

Fig. 5. The conjunctiva may be closed with interrupted or mattress plain 4- or 5-0 gut sutures.

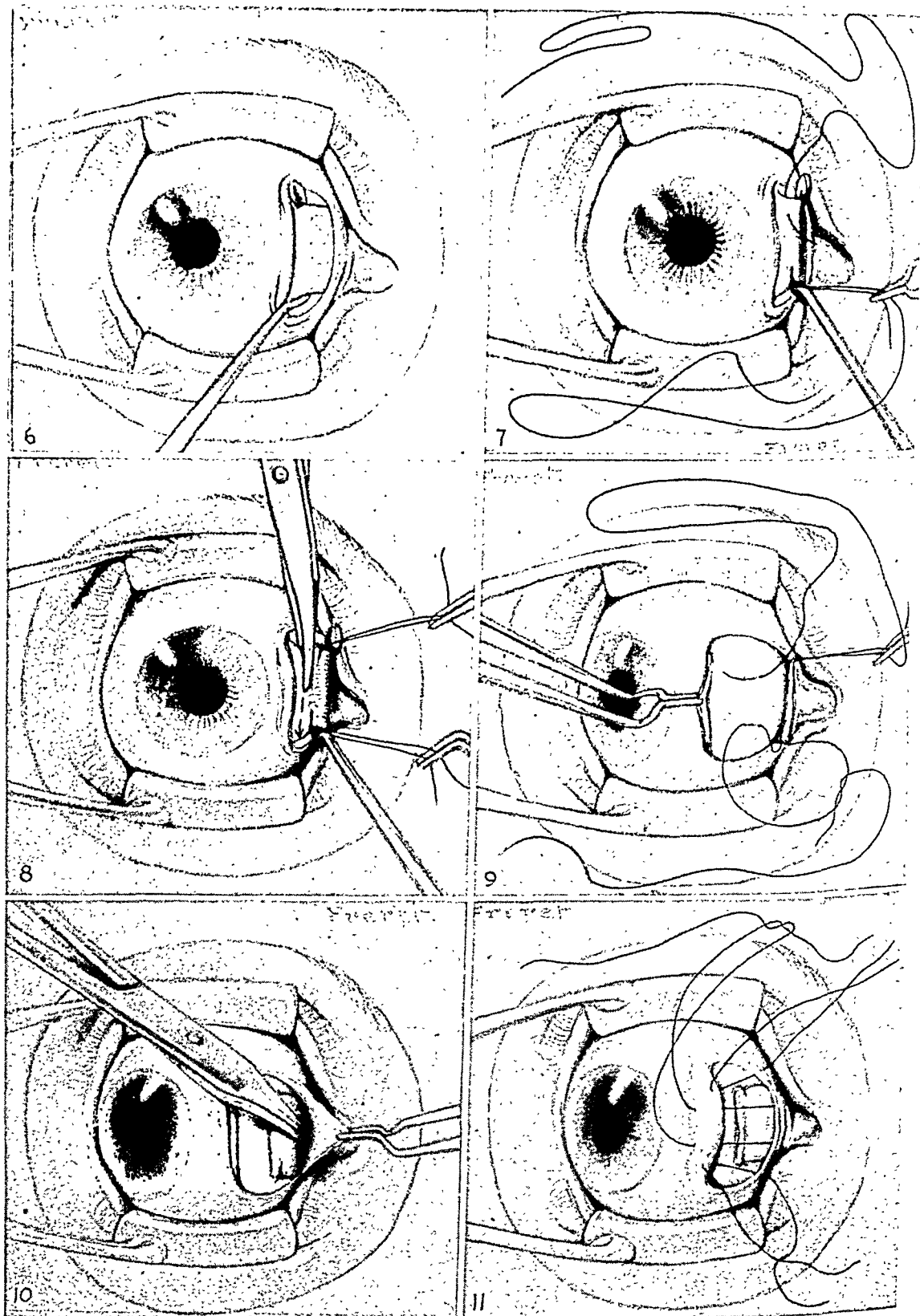
Technique of the operation of resection and advancement of a rectus muscle. The conjunctiva over the tendinous insertion of the rectus muscle is divided, and the Tenon's-capsule sheath of the muscle exposed. The sheath is picked up with forceps at one side of the tendon and buttonholed. Forceps are used to grasp and hold the tendon while a muscle hook is passed accurately and carefully beneath the tendon of the muscle to the opposite side, so that a little tent of Tenon's capsule is raised on the point of the hook (fig. 1). Careful observation is then made to ascertain whether the complete tendon has been included. The close relationship of the inferior oblique insertion to the lateral rectus tendon should be remembered, so that the former will not be included in any procedure. Should this have been done, Tenon's capsule is carefully severed from its attachment to the muscle and stripped back to expose the bare muscle slightly beyond the point at which the resection is to be performed. A muscle clamp with multiple teeth is slipped across the muscle belly at least 4 to 5 mm. from the tendinous insertion and the tendon is severed with scissors so that a 2 to 3-mm. stump is left attached (fig. 2). Then 5-0 white braided silk sutures on atraumatic needles are passed through 2 or 3 mm. of both margins of the muscle belly at the desired opposite points, and a single loop tie is made in each to hold the sutures at these points and prevent their slipping through the muscle fibers (fig. 3). The muscle forceps are then removed and the muscle advanced, the needles being passed from beneath the very insertion of the tendon out through its surface and tied securely, bringing the muscle forward and enhancing its action (fig. 4). A third suture may be used in the center of the muscle and the tendon, if this seems desirable. Very little or no muscle or tendon tissue is removed. There may ap-

pear to be a slight excess of tissue, but when healing has taken place there should be no lump or deformity. The conjunctiva is carefully closed with 4-0 plain gut sutures (fig. 5).

RECESSION—RETROPLACEMENT

The principle of recession or retroplacement may be used to relieve spasm or overaction of a muscle. It is applicable to the rectus muscles and to the inferior oblique at its insertion.

Technique of the operation of recession or retroplacement of a rectus muscle. The operation of recession may be applied to any overacting rectus muscle. The incision is made over the tendinous insertion of the muscle, exposing Tenon's capsule and the muscle. Tenon's capsule at one margin of the tendon is buttonholed, the tendon grasped with forceps, and a muscle hook slipped carefully beneath the tendon to the opposite side where Tenon's capsule is again buttonholed. Then the muscle is denuded of its sheath (fig. 6). Single-armed 5-0 white braided silk sutures on atraumatic needles are passed through the tendon as close to the insertion as possible and a single-loop tie is made to secure the tendon from slipping (fig. 7). The tendon is then carefully severed as close to flush with the sclera as possible, allowing the muscle to retract (fig. 8). Fixation forceps are applied to the exact center of the stump of the tendon, and the point of recession measured from the stump and marked lightly on the sclera with calipers. Then the atraumatic needles and sutures on either side of the muscle are in turn inserted at the marked points, 1 to 1½ mm. of the outer layers of sclera picked up and passed through, and the end of the receded muscle is brought up to the retroplacement point as measured on the sclera. There the sutures are tied carefully in place



Figs. 6 to 11 (Kirby). Right eye illustrated. Recession of the medial rectus muscle. Fig. 6. Isolation of the medial rectus muscle on a hook. Tenon's capsule has been freed from the muscle fibers and dissected back.

(fig. 9). Inspection and observation then confirm whether the exact amount of recession necessary has been accomplished (fig. 10). The subconjunctival tissue is undermined when necessary. This is particularly important if it is the medial rectus muscle that is recessed. The conjunctival incision is closed with interrupted plain 4-0 sutures. In the case of the medial rectus, the central is matted through the conjunctival edge of the semilunar fold, through the stump of the previous tendinous insertion, and through the other edge of the conjunctiva to make sure that the semilunar fold and the caruncle are advanced (fig. 11).

The handling and care of Tenon's capsule and other fascias in ocular-muscle surgery. In all surgery of the ocular muscles, the fascial attachments and the check ligaments must be kept in mind and properly handled to produce the desired results. I have made it a practice to denude the muscles of their Tenon's-capsule sheaths. If Tenon's capsule and particularly the check ligaments are resected, there may result an unwanted limitation of rotation. If the tissues anterior to the medial rectus muscle are receded with the muscle there results a sinking of the caruncle and of the semilunar fold, producing a cosmetic blemish of the appearance of an artificial eye. I repeat that I make

it a practice, after performing recession of the medial rectus muscle, to undercut the semilunar fold and caruncle well back and to bring these tissues forward to be attached to the stump of the previous insertion of the muscle to prevent the sunken appearance. In general, it is well to bear in mind that resection or advancement of a horizontal muscle narrows the palpebral fissure, whereas recession or tenotomy widens it. The superior and inferior recti have important fascial attachments to the upper and lower eyelids, respectively. Resection of the superior rectus muscle with its fascia for correction of hypotropia may narrow the palpebral fissure and produce a partial true blepharoptosis. This may be avoided somewhat if the muscle is dissected clean of its fascia and only muscle tissue resected and advanced. Recession of the inferior rectus muscle may result in lowering the level of the lower eyelid and widening the palpebral fissure, whereas resection of the inferior rectus and its fascia may raise the lower eyelid. The procedure of stripping back the fascia and exposing the muscle tissue itself for the procedures will minify although it will not prevent the undesired changes in the position of the eyelids.

The extent of surgery for strabismus. The degree of resection or recession must



Fig. 7. Two 5-0 white braided silk sutures on atraumatic needles are passed through the margins of the tendon almost directly at the insertion. The sutures are tied to prevent slipping of the fibers.

Fig. 8. While the strands of the suture material are held lightly away, Stevens scissors are used to sever the tendon at its insertion.

Fig. 9. The central portion of the tendon stump is held with forceps. The estimated degree of recession has been accurately marked with calipers. The needles and sutures are passed through the outer layers of the sclera, then the receded muscle is brought to the new attachment to be sutured in place.

Fig. 10. The muscle is shown receded to its new position. To prevent sinking of the caruncle and the semi-lunar fold, these are undermined with Stevens scissors.

Fig. 11. A satisfactory method of closing the conjunctiva. The undermined caruncle and semi-lunar fold are brought forward by a double-armed plain 4- or 5-0 gut suture which is passed through the tendon stump, then through the conjunctiva and tied. Single-armed sutures are used above and below the central mattress suture.

be varied according to the individual case and conditions as demonstrated by pre-operative functional tests as well as by the appearance of the muscles at the time of operation. In general, up to 8 to 10 mm. of a weak muscle may be removed in the procedure of resection and advancement. The recession or retroplacement of a medial rectus muscle should not be over 5 mm., while that of the lateral rectus muscle may be 6 to 7 mm., depending on the size of the eye. Right judgment of the extent of the operation is acquired only through experience in the results obtained, and is affected by the individual surgeon's methods of dissection, the sutures used, the handling of the tissues, and the patient's reaction to surgery.

The sutures used in ocular-muscle surgery. Buried nonabsorbable nonirritating 5-0 braided white silk or 5-0 chromic gut sutures are used in the operation of recession because it has been found by experience that they are superior for the purpose to plain gut, heavier chromic gut, or exposed silk sutures which require removal. The use of plain, absorbable gut sutures for closing the conjunctival incision has proved very satisfactory. They do not require removal. This is a great advantage, particularly in the case of children. The sharp atraumatic needle with the suture welded into its butt end offers great advantages over the older bulkier form of needle that required threading through the eye of the needle.

THE APPLICATION OF SURGERY

Both the usual and unusual types of strabismus will be considered.

SURGERY OF THE USUAL CASES OF STRABISMUS

Recognition and establishment of the correct diagnosis of the various motor anomalies will help greatly and serve as

the proper guide in the application of surgery. Some of the conditions in which surgery may be used advantageously are: (1) Convergence or adduction excess and divergence or abduction insufficiency associated with convergent strabismus. (2) Divergence or abduction excess and convergence or adduction insufficiency associated with divergent strabismus. (3) Vertical deviations existing alone or associated with horizontal deviations and due to weakness or overaction of any one or more of the elevator or depressor muscles.

Cases of esotropia associated with convergence excess. Convergence excess resulting in convergent strabismus may be defined as the condition in which the existing hyperopia of varying degrees induces excess accommodative effort and excessive convergence. For example, if a patient has three diopters of hyperopia, he must exercise three diopters of accommodation for clear vision at infinity, which for practical purposes is at any point beyond 6 meters or 20 feet. This added accommodation and convergence are also exercised at any point of fixation within infinite distance. It is difficult for the patient to maintain fusion under such conditions, and convergent strabismus may result. The inward deviation of the eyes is greater for near than for distance vision. Early correction of the hyperopia in such a case may save the patient from the development of strabismus and loss of binocular single vision. In surgery as applied to cases of esotropia associated with convergence excess there may be indicated recession of one or both medial rectus muscles, although resection or advancement of the lateral rectus is usually necessary in long-standing cases.

Cases of convergent strabismus associated with divergence insufficiency and

unilateral or bilateral abduction paresis.

Divergence insufficiency is a condition in which the function of divergence or returning the eyes to parallelism after any act of accommodation and convergence is less than normal. The deviation is greater for distance than for near vision. The function of divergence may, as an entity, be impaired, or there may be weakness of one or both lateral rectus muscles. In cases of lesser degree, prisms, base out, may give relief; however, if of greater degree than can be dealt with by prisms and fusional reserve, or if convergent strabismus with weakness of abduction is present, surgery is indicated. Resection of the lateral rectus in one or both eyes may be necessary. A secondary overaction of one or both medial rectus muscles may also indicate the necessity of recession or retroplacement of one or both of the medial recti. Fibrosis of the medial rectus may produce convergent strabismus and stimulate paralysis of the lateral rectus muscle. Recession of the fibrosed muscle may help much in producing cosmetic and functional improvement.

Cases of divergent strabismus associated with divergence excess.

Divergence excess is a condition in which the eyes instead of returning from convergence to parallelism on relaxation from near to distance fixation may actually deviate outward. The deviation is greater for distance than for near. Normal power of convergence may be present. Usually fusion is maintained, and the strabismus, if present, is intermittent indefinitely or for a long while before it becomes constant. The prognosis with surgery is good. Recession or tenotomy of one or both lateral rectus muscles may be indicated. It is usually unnecessary to touch the medial rectus muscles.

Cases of divergent strabismus associated with convergence insufficiency and adduction insufficiency. Convergence insufficiency is a condition in which the stimulus from the convergence center may be weak, although the medial rectus muscles themselves, individually, also may be paretic. The divergent strabismus that results is greater for near than for distance vision. It may be improved by convergence exercises and by appropriate lenses. The condition is difficult to correct by means of surgery, even when the principle of advancement or resection of the medial rectus muscle, one or both, is applied. It is usually necessary in marked cases of divergent strabismus due to convergence insufficiency to perform also a tenotomy or recession of one or both of the lateral rectus muscles.

Vertical deviations of the eyes. Hyper tropia and Hypotropia.

Vertical deviations are those in which hypertropia or hypotropia exists because of weakness or overaction of one or more of the elevator or depressor muscles. A common example is that of hypotropia due to weakness of a superior rectus muscle. If the patient elects to fixate with the paretic eye, however, overaction or spasm of the inferior oblique of the fellow eye usually results. This condition may be bilateral and alternating. If both elevators of one eye are paretic, the sound eye usually fixates and the paretic eye is found in a position of hypotropia. Vertical deviations may develop as a defense mechanism, the patient involuntarily moving one of his eyes to a position where its image will least interfere with that of the fixating eye. Vertical deviations may be associated with horizontal deviations. Surgery may be applied for the correction of vertical deviations in the form of tenotomy, recession, resection, or advancement of the overactive vertical muscles, as indicated. Resection

or advancement of the paretic muscle or muscles will probably not alter the fixation with the paretic eye, and the phenomenon of overaction of the muscles of the sound or fellow eye will remain.

Spasm of the inferior oblique muscle. Ocular torticollis. Spasm or overaction of the superior rectus or of the inferior oblique muscle with variable hypertropia may develop in cases of paresis of one or more elevator or depressor muscles. It is commonly seen with paresis of the superior rectus, and may be unilateral or bilateral. It is probably an expression of the patient's effort to avoid diplopia. The phenomenon of ocular torticollis with head tilting and rotation is often associated with inferior oblique and superior oblique muscle anomalies. In such cases the orthopedist will do well to have the ocular condition examined and corrected first before the sterno-cleido-mastoid muscle is touched. The spasm or overaction of the inferior oblique muscle may be corrected by free myotomy or myectomy at the origin of the muscle as indicated by the degree of overaction of the muscle, or the approach may be made at the insertion, the muscle being recessed according to the technique of White.¹ In case of inferior oblique paralysis with overaction of the superior rectus of the fellow eye, recession of the overactive superior rectus muscle is in order.

SURGERY OF UNUSUAL CASES OF STRABISMUS

Transplantation of superior and inferior rectus muscles in case of paralysis of the lateral rectus muscle. If there is congenital paralysis of the lateral rectus muscle in which convergent strabismus exists with flaccid, atrophic lateral rectus muscle, or if the muscle tissue has been replaced by fibrous tissue, resort may be had to transplanting the lateral half

of the superior and inferior rectus muscles by means of a simple technique. After a conjunctival incision has been made over the lateral rectus, the condition of the muscle is evaluated. If any well-functioning lateral rectus muscle tissue is present it may be resected and advanced. If the tissue is flaccid and atrophic it is not disturbed, but if it is replaced by fibrous tissue, the latter is removed. Through the lateral conjunctival incision, which need not be enlarged for the transplantation of the superior and inferior rectus muscles, a hook is passed to engage the superior rectus and to bring it into the field of operation. A white 5-0 silk suture is passed through, looped around the outer half of the superior rectus tendon, and tied once to secure the fibers from slipping. Then with de Wecker scissors the outer half of the tendon is severed and the muscle split about 10 mm. backward. The same procedure is applied to the inferior rectus; and two transplanted half muscles are sutured to the lateral rectus stump. It is usually also necessary to perform a recession of the medial rectus muscle.

Reconstruction in cases wherein an overcorrection has followed surgery for the correction of strabismus. Although temporary overcorrection may be necessary to achieve results in some cases of divergence excess, it is wise to use every precaution to avoid overcorrection in cases of convergent strabismus. Eyes in the former case adapt themselves readily, usually regaining fusion with sufficient amplitude; if reattachment of the recessed lateral rectus does not occur, the overcorrection may right itself and the final result vary from orthophoria to a moderate degree of exophoria. Overcorrection may develop in cases of divergence excess with good power of convergence if the medial rectus is advanced

or if exsection of lateral-rectus tissue is performed. Cases of divergent strabismus due to convergence insufficiency are difficult to overcorrect although it is possible. Cases of convergent strabismus due to divergence insufficiency with paresis of divergence or with paresis of one or both lateral rectus muscles and those due to convergence excess may be overcorrected (1) if too much lateral rectus muscle tissue is resected, (2) if Tenon's capsule or the check ligament of the lateral recti are included in the resection or advancement, (3) if a complete tenotomy of the medial rectus is made at its insertion, or (4) if it is recessed too far back from its insertion so that it cannot exert its proper action. The cosmetic blemish and the functional disturbances from overcorrection are very disturbing to the patient and to his relatives.

The use of Tenon's capsule transplants in cases of overcorrection and abnormal muscle adhesions. The measures undertaken for repair of overcorrection were in general unsuccessful until the principle of Tenon's-capsule transplant for the relief of muscular adhesions hindering muscular action was employed. The ability to bring a muscle anterior to a previously placed normal or abnormal or adventitious insertion in the sclera was exemplified by Berens.² If the denuded area on the sclera from which is removed the abnormally retroplaced or adherent muscle is not covered by Tenon's capsule, the attempt to move the muscle forward to a new or more anterior insertion will fail, for an adhesion will form between the belly of the muscle and the denuded area where they come in contact. The insertion will remain where it was and the muscular action and function or effect will not be improved or not sufficiently improved to be satisfactory. The technique of covering the denuded area of

sclera with a free or pedunculated or sliding graft of Tenon's capsule, utilizing tissue to which the muscle is normally accustomed as a sheath and to which it will not adhere is well described by Berens. Its employment can be definitely recommended from my personal experiences.

The surgical correction of strabismus fixus. As a result of congenital anomaly, or prenatal or postnatal inflammation or trauma, there may develop strabismus fixus with adhesions of varying degree and extent between the globe and the walls of the orbit. Such conditions are necessarily difficult to correct; they require severance of the adhesions and sliding grafts of Tenon's capsule to cover the denuded areas in order to prevent their re-formation.

Surgical reconstruction necessary in cases of replacement of muscle tissue by fibrous tissue. As a congenital developmental anomaly or because of inflammation or trauma, normal muscle tissue may be replaced by fibrous tissue in whole or in part. This condition causes limitation of rotation in the field of action of the involved muscle and retraction when the antagonist muscle, if normal, is activated. The most familiar retraction syndrome is that of the enophthalmos produced on adduction of the affected eye by the medial rectus muscle when the lateral rectus muscle has been replaced by fibrous tissue. I have in such cases performed either a recession of the medial rectus for partial correction of a manifest convergent strabismus or have removed the fibrous tissue and transplanted the lateral halves of the superior and inferior rectus muscles and combined this procedure with a recession of the medial rectus muscle. I have seen replacement of the superior rectus muscle as the cause of paralysis of elevation with

ptosis. There was retraction of the globe on downward gaze. If there is definite hypotropia, recession of the inferior rectus may be done. Fibrosis of the medial rectus may cause convergent strabismus and simulate paralysis of the lateral rectus. Exposure of the muscles at the time of the operation may reveal good muscle tissue in the lateral rectus muscle. In such a case, recession of the fibrosed medial rectus and resection of the lateral rectus are in order.

Surgical reconstruction of cases of paralysis of elevation with real or pseudoblepharoptosis. Certain cases may, as a congenital anomaly, or due to hemorrhage or trauma, exhibit a condition of unilateral or bilateral hypotropia with real or pseudoblepharoptosis. There is a paresis or paralysis of the superior rectus and of the inferior oblique muscles. Subjective and objective tests will disclose whether the blepharoptosis is real or pseudo. The decision may be made whether the lid is down because the eye is down and that it will lift when the eye is elevated by the surgical procedure of shortening the paretic or paralyzed superior rectus and inferior oblique muscle tissues. In the latter case, no further operation may be necessary for the correction of the blepharoptosis. The superior rectus may be resected and advanced according to the technique given under the foregoing heading, "*The technique of the operation of resection and advancement of a rectus muscle.*" The resection and advancement of the inferior oblique is best performed through a curvilinear skin and fascial incision at the inferior margin of the orbit. The muscle is exposed and, after being secured with two 5-0 white braided silk sutures or 4-0 10-day chromic gut sutures, is severed from its insertion and advanced over the orbital bone and secured to the periosteum

of the nasal bone in a bed which has been dissected for the purpose. The orbital fascia is closed by a third white silk suture and the skin by a subcuticular, sliding 5-0 black suture. This technique except for the suture material was developed and used by Wheeler.³ These procedures have been satisfactory for the correction of a bilateral case of this condition with pseudoptosis.⁴ A variation of the approach to the inferior oblique might be made by resecting and advancing the inferior oblique at its insertion.

SUMMARY AND CONCLUSIONS

The personal training and experiences of the author in handling cases of strabismus have been given in detail. Careful preoperative study of the patient's monocular vision, refraction, accommodation, convergence, divergence, monocular and binocular uncover tests both in primary as well as in the six cardinal positions of gaze, degree of fusion if present, proper diagnosis, and the use of orthoptic exercises with corrective lenses, when indicated, are necessary before surgery.

This may well be performed at an early age if correction of the strabismus is not obtained by orthoptic measures. The plan of operation may be made before the incisions are begun, but the actual details of the procedure and the extent of the surgery may not be evident before exposure and examination of the muscles. It is well not to have any routine technique in mind, but to vary the procedures individually according to the case under observation. It is best not to operate on too many muscles at one time and particularly not to do too much. It is better to have an undercorrection that is amenable to further correction than to be confronted with an overcorrection that is difficult to reconstruct. A conservative approach is best. If a secondary operation

seems necessary, it is best to allow sufficient time to elapse so that the tissues may heal and resolve before the next procedure is attempted.

The techniques which have been satisfactory in diminishing the function of an overactive muscle by tenotomy, myotomy, myectomy, and by recession or retroplacement and those which have been found good in enhancing the action of weak muscles by advancement or resection, have been described in detail and original illustrations have been used to clarify further the methods. Particular stress is given to the proper handling of the conjunctiva, of the muscles of Tenon's capsule and the other fascias and to the methods of suturing.

The usual cases of convergent strabismus arising from convergence excess or divergence insufficiency, or divergent strabismus arising from divergence ex-

cess or convergence insufficiency, of vertical deviations of the eyes due to paresis of the superior rectus and associated overaction of the inferior oblique of the fellow eye as well as the unusual cases of paralysis of extrinsic ocular muscles, of different cases of overcorrected strabismus, strabismus fixus, replacement of muscle by fibrous tissue, and finally the condition of paralysis of elevation, have all been discussed and the indications for surgery outlined.

The problems of diagnosis are stressed to avoid the pitfalls of application of unsuitable procedures. Proper care and orthoptic training after surgery are urged to achieve satisfaction and to accomplish the greatest goal, binocular single vision with depth perception whenever this is possible.

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A CENTER FOR OCULAR DIVERGENCE: DOES IT EXIST?*

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The existence of a center for ocular convergence in the brain is well established.¹ Evidence for the existence of a separate center for ocular divergence, presented by Bruce,² is much less convincing. The convergence center has been located anatomically by Bender and Weinstein,³ but no anatomic location has been demonstrated for a divergence center.

Arguments for the existence of a divergence center, short of its anatomic localization, come from many sources. Our purpose is threefold. First, we shall review these arguments and demonstrate that they do not necessarily require the existence of a divergence center. Second, we shall present an argument that the results of the disruption of fusion in the tests for heterophoria may be interpreted in terms of a single convergence center rather than in terms of two separate centers, one for convergence and the other for divergence. Third, we shall present the elasticity theory of divergence and arguments in its favor.

ARGUMENTS FOR A DIVERGENCE CENTER

One interpretation of divergence has been expressed by Duane⁴ when he defined it as that function by virtue of which the visual lines, when converged on a near object, are made to separate in order to sight a more remote object. According to this interpretation, divergence is merely a change from a state of greater convergence of the visual lines to one of lesser convergence and, for this reason, is often referred to as a relaxation

of convergence or negative convergence⁵ instead of divergence.

A more literal interpretation of divergence would be that function by virtue of which the visual lines are actually made to diverge one from the other, with divergence beginning where negative convergence ceased; that is, the visual lines are parallel. The existence of such true divergence is not too much to expect if there actually is a separate center in the brain for divergence, functioning as an antagonist to the convergence center.

The arguments for the existence of a separate center in the brain controlling the divergence function have been summarized.² The evidence is derived from three sources: (1) phylogenetic, (2) physiologic, and (3) pathologic.

Phylogenetic evidence. Bruce² first asks the question, whether there is a function the existence of which predicates the existence of divergence and to the working of which divergence is indispensable. He answers that the function of convergence seems to fulfill this requirement. He points out that convergence without divergence would be a crippling liability as well as a biologic weakness and, further, that nature tends to suppress biologic weaknesses. The presumption is, therefore, that convergence and divergence appeared simultaneously on the phyletic scale. Since the nucleus of Perlia, the accepted center for convergence, is the last-known nucleus to become differentiated,⁶ its appearance must coincide with the appearance of divergence, according to Bruce.

In phylogeny, any function furthering fusion has been accentuated and all others have been suppressed. Hence, says

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Bruce, divergence is an essential link in the fusion chain and has been maintained. As a further proof of the essentiality of divergence in fusion, he says that "... in carrying out divergence the healthy eyes will, with unerring precision, fix the object sought. Diplopia must be accepted as the sine qua non of ocular paralysis in a previously binocularly sighted person. . . . In paralysis of divergence, diplopia supervenes, and it is therefore necessary to look on the function of divergence as an essential agency in maintaining fusion." The justification for bringing in divergence paralysis under phylogenetic arguments is not quite evident. He mentions divergence paralysis later, however, under pathologic arguments where one would more logically expect to find it.

Physiologic evidence. Bruce says "... True fusion connotes the ability to focus the visual axes on points at varying distances, and the function of divergence is the sine qua non of this ability." He thus seems to accept Duane's interpretation of divergence, and then reaches the crux of the matter by posing the question: Is divergence active or passive? His answer is that if it is entirely passive, the position of rest should invariably be divergent. Maddox⁷ who believed that divergence was active, nevertheless says of the divergence reflex "... the only one I have not been able to prove positively." It has been pointed out that the eyes *are* divergent in deep sleep⁸⁻¹² or narcosis,^{8, 10, 11} in death before rigor sets in, and in cases of blindness,⁸ and even in cases of innervational esotropia under anesthesia.¹²

If, on the other hand, divergence is active, Bruce reasons that testing divergence with prisms should, and does, lead to "... the same sense of strain" as when convergence is tested with prisms.

Perhaps the "sense of strain" in any prism vergence test comes from the individual's unusual experience in attempting to overcome a threatening diplopia by the use of the fusion process rather than from the strain on any one particular set of extraocular muscles. Bruce admits that Landolt¹³ was right in stating that divergence cannot be increased by exercise. If divergence is active rather than passive, it seems strange that it cannot be increased by exercising with prisms of gradually increasing strength placed base in. Bruce's opinion, however, is that divergence is active rather than passive.

Finally, he remarks that if divergence is entirely passive, it should begin rapidly and then progress more slowly. Since divergence (as defined by Duane and interpreted by Bruce) occurs at a uniform speed, it must be active. He then brings forth a mild contradiction by postulating that when divergence is first initiated, the external rectus muscle is stretched and *does not contract actively* (italics our own); the initial passive abduction is checked, he says, by finely graded tonic movements of the medial rectus. As divergence proceeds, the external rectus begins to contract to an increasing degree. This would seem to be an admission that divergence is at least passive at the outset of movement—in spite of his former statement that divergence is active, not passive. Duane⁴ believed that divergence had both active and passive components.

According to Cridland,¹⁴ there are three records in the literature of potential voluntary divergence.^{15, 16, 17} Of these, Cridland says that the first two suggest an extreme degree of voluntary inhibition comparable to the fakir's control of pain or the same phenomenon in firewalkers. How is it possible, he asks, to differentiate between voluntary excitation of one

set of muscles and voluntary inhibition of another set by introspection alone? Hansen Grut⁸ said "... no one is able to bring about a divergence of the two eyes ... because the habit and practice of such a movement is altogether absent."

On the other hand, the abduction of one eye while the other fixates is frequent, according to Bruce, who, in turn, cites Willbrand and Saenger,¹⁸ Spiller,¹⁹ and Reese.²⁰ Bruce himself has seen two such cases in patients of whom he says "... they were obviously relaxing their accommodation and convergence and thus allowing their eyes to return to what was for them the position of rest." In the same connection, Livingston²¹ refers to "... an ocular fatigue of sufficient amount to produce a palpable exophoria." Yet Bruce has said previously that the position of rest would be one of divergence *provided* divergence were passive, but that divergence is not passive but active! To quote Bruce further, "Divergence then, while partially an active process, is not a volitional function. It is obvious, however, that it is dependent on volitional impulses for its initiation." This is somewhat confusing, to say the least. Finally, if divergence is dependent on volitional impulses for its initiation, he finds an explanation by citing Hering, who stated that the motivation of divergence lay in attention!

Pathologic evidence. The only factual argument put forth by proponents of the existence of a divergence center is the clinical entity known as "divergence paralysis." Von Graefe²² reported the first case, and Smith²³ the second. It was Parinaud²⁴ who first put the entity on a logical basis, and finally Duane²⁵ described it in classic fashion. The etiology of divergence paralysis varies but is usually a disease of the brain such as encephalitis, syphilis, tabes, multiple sclerosis, lead poisoning, hemorrhage,

hysteria, diphtheria, poliomyelitis, chorea, or metastatic carcinoma.

Bielschowsky¹¹ listed seven characteristic findings in divergence paralysis: (1) homonymous diplopia for all objects beyond a certain distance, usually 10 to 20 inches; (2) the angle of squint remains unchanged or decreases slightly in secondary positions of gaze; (3) if an object is brought near to the patient, the two images approach each other and finally fuse when the object is 10 to 15 inches away; (4) when the object is brought still nearer, insufficient convergence causes crossed diplopia; (5) prisms base out give binocular single vision throughout the entire field of fixation and at any distance; (6) there is no restriction of the field of fixation of either eye; and (7) the angle of squint is relatively constant on repeated examinations. Bielschowsky, however, admits that he is forced to agree with Alfred Graefe²⁶ and Berry²⁷ that "divergence paralysis" might well be convergence spasm instead, although he is sure that a divergence innervation exists. He further says that his most characteristic cases of "divergence paralysis" developed quite suddenly into frank, bilateral sixth-cranial-nerve paralyses!

Bruce lists two other anomalies of divergence in addition to "divergence paralysis." One of them, divergence insufficiency, he says is due to a progressive convergence excess, in most cases. The other, divergence excess, he says is a true innervational anomaly and gives Bielschowsky²⁸ as a reference; in the next sentence, Bruce says that "... the etiology is obscure," and admits that "... one type of divergence excess is a sequela of convergence weakness." How any of these anomalies of divergence are conclusive arguments for the existence of a divergence center is difficult to see, since all three of them could well be con-

vergence anomalies instead.

In summation, Bruce quotes Gould²⁹ who defines a center as "... the ganglion or plexus whence issue the nerves controlling a function." He then reasons that a divergence center must exist, having arrived at this conclusion by a process of deduction. It is axiomatic, he says, that no function of importance is without its center. As a point in passing, one wonders about the function of accommodation; a center for positive accommodation has been demonstrated anatomically³ but as yet there has been demonstrated no center antagonistic to positive accommodation. "Given a state of convergence, lateral divergence must obviously be carried out by (1) elasticity, and/or (2) actual contraction of the external rectus. The roles played by these processes have already been discussed and it has been found that the major part is played by the latter of these two possibilities," says Bruce. His statement "... it has been found" is based purely on deductive reasoning. He concedes that actual contraction of the external rectus occurs only as a result of innervation which can come from (1) the sixth-cranial-nerve nucleus, or (2) other sources. Since, in divergence paralysis, the sixth nerves are intact (at least for a time), the source of the innervation must be "other." The "other" is a divergence center which is probably in the midline, concludes Bruce.

The arguments presented for a divergence center can be briefly summarized: (1) phylogenetic—divergence must have developed as a necessary antagonist of convergence and both have been maintained in the interests of fusion; (2) physiologic—divergence is active and hence must have its own innervational center; and (3) pathologic—since "divergence paralysis" is known, it must be produced by a lesion in the divergence center.

EVIDENCE FOR ONE CENTER ONLY

If two separate centers actually exist in the brain for the control of ocular convergence and ocular divergence, this fact should be demonstrable by experimental techniques. Localization experiments similar to those performed by Bender and Weinstein³ may establish the presence of a center for convergence, but failure to locate a center for divergence by such a technique is not evidence that such a center does not in fact exist. Evidence that one center alone is sufficient to account for the functions of both divergence and convergence must come from other types of experiments. The experimental disruption of fusion, such as is produced in heterophoria testing, provides evidence that only one center exists.

The mere fact that numerous tests for heterophoria exist, each with its ardent advocates, is proof that no one test is completely satisfactory. The works and ideas of all those who have written on heterophoria show marked differences in concept and opinion. Dobson³⁰ believes that all lateral-muscle imbalances are errors of convergence and all tests for heterophoria are convergence tests. Prangen,³¹ in contrast to Dobson, believes in a divergence and a convergence mechanism; he thinks that when exophoria is present it is because the divergence mechanism is dominant. Conversely, when esophoria is found, the convergence mechanism holds sway.

Tests for heterophoria. Because of the multiplicity of tests for heterophoria, it is necessary to digress at this point to describe the tests used for the present study. These were (1) the Maddox-rod test, and (2) the screen-Maddox-rod test.³²

The Maddox-rod test is so widely known that it needs little description. While the examinee looks at a spot of

light (a muscle light), the Maddox rod is placed before one eye and the subject asked to adjust, by means of a Risley rotary prism, the position of the line of light to a point where the line bisects the light. Several moments of waiting are often necessary until all movement of the line has ceased. A reading is then taken in prism diopters directly from the calibrated rotary prism frame.

For determining heterophoria with the screen-Maddox-rod test, the Maddox rod is placed before one eye. The examinee is then directed to fixate the muscle light, and a cover is placed before the eye behind the Maddox rod. The cover is removed regularly for a period of one second at about three-second intervals, the other eye, meanwhile, being allowed to maintain fixation constantly. The purpose of this very brief uncovering or "flashing" of the eye behind the Maddox rod is to weaken further the fusion control. If the eye is left uncovered for any but the briefest of periods, various innervations begin to appear which produce a fluctuation of the deviation with a consequent shifting or jumping about of the image of the line. The examinee adjusts the flashing line to a position where it bisects the light, again with the use of a Risley prism, and the deviation is then recorded in prism diopters.

Each of these tests is highly reproducible, provided an identical testing technique is used under identical testing conditions.^{14, 33}

Esophoria and Exophoria. If esophoria and exophoria are separate entities, the independent existence of each could easily be construed as an argument for the existence of separate centers for convergence and divergence, respectively. If, on the other hand, they are interdependent and have no separate existence—that is, esophoria being the result of an in-

creased convergence innervation and exophoria a result of a decreased amount of this same convergence innervation—the evidence for a single convergence center is considerably strengthened.

These two types of heterophoria tests, as Adler¹² has pointed out, will give different measurements, depending on the extent to which they eliminate the visual fusional stimuli. The Maddox-rod test measures the effectiveness of dissimilar retinal images for holding the eyes straight relative to the effectiveness of similar images. The screen-Maddox-rod test measures the effectiveness of monocular retinal stimulation relative to the effectiveness of stimulating the two retinas simultaneously. With the screen-Maddox-rod test, if esophoria and exophoria are separate entities, the added dissociation produced between the two eyes by the addition of screening to the test should uncover more esophoria and more exophoria than when screening is not used. If, on the other hand, esophoria and exophoria are simply different degrees of a single property, then screening may reveal more of one but less of the other.

This is a question which may be answered by testing a group of subjects with and without screening during the Maddox-rod test.

Effect of screening and not screening. An experiment was designed so that the difference between screening and not screening could be observed in eight different testing conditions. One of these testing conditions, for example, called for a testing distance of 20 feet with a red Maddox rod before the dominant eye (20-D-R). Another condition called for the same testing distance but with a white Maddox rod over the dominant eye (20-D-W). All eight of the testing conditions are listed in detail in table 1.

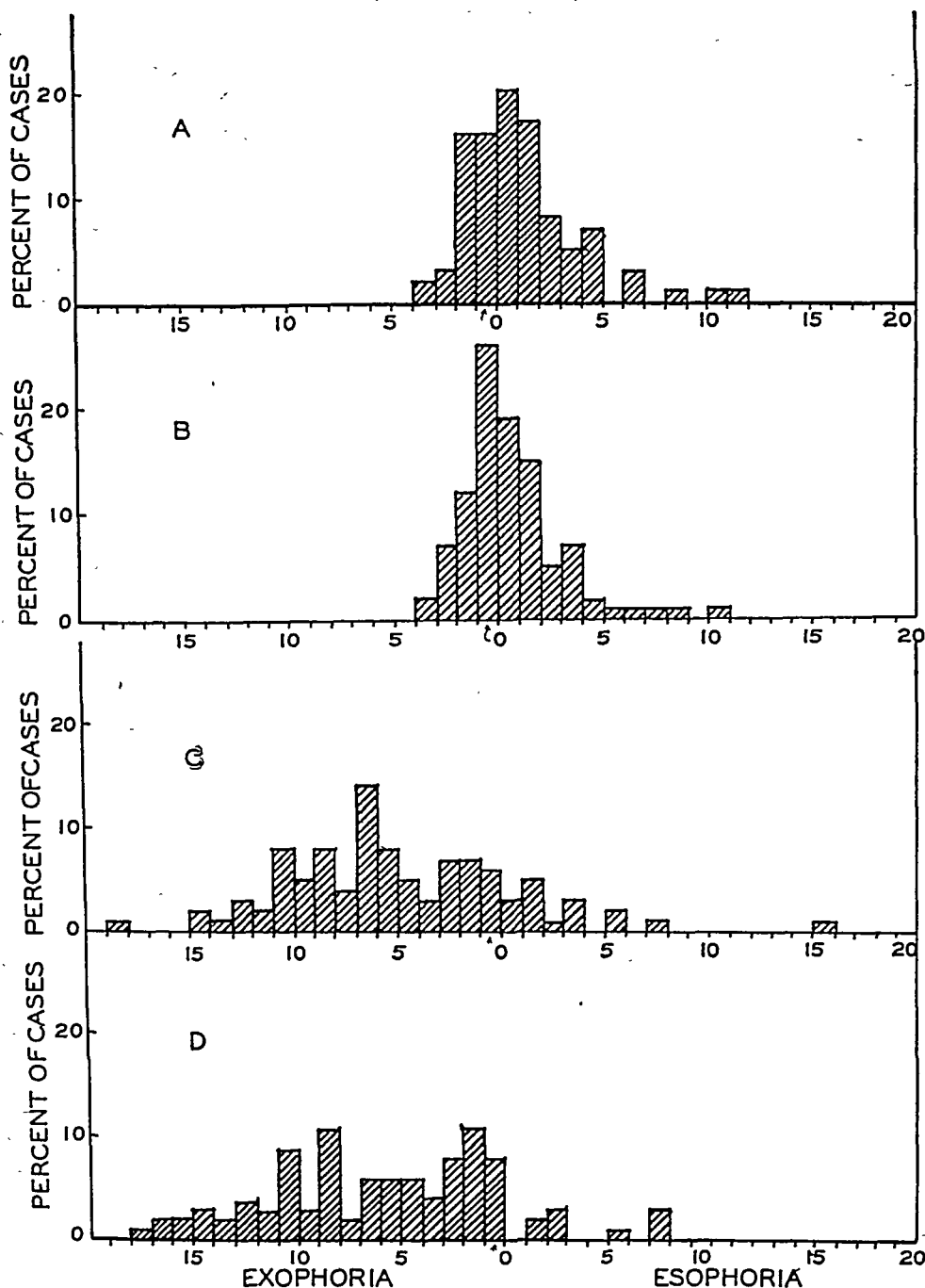


Fig. 1 (Scobee and Green). Distribution of heterophorias (scale in prism diopters) of 100 subjects tested: A, with screening, at 20 feet; B, without screening, at 20 feet; C, with screening at 13 inches; D, without screening, at 13 inches.

For each condition, the results of testing 100 healthy young male subjects, both with and without screening, are described by averages and standard deviations. The standard deviation has been chosen as a

measure of variability even though the distributions of heterophoria on a scale of diopters are slightly asymmetrical.

For the test 20-D-W performed without screening, the amounts of hetero-

phoria uncovered averaged 1.11 prism diopters of esophoria. The standard deviation was 2.40 prism diopters. The frequency distribution of the 100 heterophoria readings is shown in figure 1B, where it may be seen that the readings vary from 3 prism diopters of exophoria to 11 prism diopters of esophoria. For the same test, 20-D-W, performed with screening, the average was 1.58 prism diopters of esophoria and the standard deviation was 2.67 prism diopters (fig. 1A). The effect of screening was to pro-

the dispersion is greater with screening than without screening, this is evidence that screening uncovers more esophoria and more exophoria. If, on the contrary, the dispersion remains essentially the same with screening as without screening, this is evidence that screening merely causes a shift in the total distribution toward *more* esophoria, but *less* exophoria. An analysis of the heterophoria records for increases in dispersion accompanying the use of screening shows that there are no consistent increases or,

TABLE 1

AVERAGE HETEROPHORIAS AND STANDARD DEVIATIONS IN PRISM DIOPTERS OF EIGHT VARIATIONS OF THE MADDOX ROD TEST, WITH AND WITHOUT SCREENING. NUMBER OF CASES, $n=100$

Test	Averages			Standard Deviations			Correlation Coefficient
	Without Screening	With Screening	Difference (with—without)	Without Screening	With Screening	Difference (with—without)	
20-D-R	+1.49	+1.80	0.31	2.67	2.65	-0.02	+0.88
20-D-W	+1.11	+1.58	0.47	2.40	2.67	+0.27	+0.90
20-N-R	+1.55	+1.89	0.34	3.07	2.98	-0.09	+0.96
20-N-W	+1.33	+1.70	0.37	2.38	2.90	+0.52	+0.88
13-D-R	-5.33	-4.97	0.36	5.52	5.29	-0.23	+0.87
13-D-W	-5.33	-4.44	0.89	5.53	5.24	-0.29	+0.89
13-N-R	-5.04	-4.99	0.05	6.07	5.66	-0.41	+0.84
13-N-W	-4.99	-4.70	0.29	5.78	5.75	-0.03	+0.83

+means esophoria (for averages only).

-means exophoria (for averages only).

20=testing distance of 20 feet.

13=testing distance of 13 inches.

D=Maddox rod over dominant eye.

N=Maddox rod over nondominant eye.

R=Red Maddox rod.

W=White Maddox rod.

duce, on the average, 0.47 prism diopters' increase of esophoria in this test.

Using the other seven testing conditions, listed in table 1, comparable differences between screening and not screening in the Maddox-rod test were found. In general, the use of screening in heterophoria testing will uncover about 0.37 prism diopters more of esophoria when the Maddox rod is used (0.37 is the average difference for all eight testing conditions).

A change in the average heterophoria reading may be accompanied by a change in the dispersion about the average. If

for that matter, no general change of any sort in dispersion associated with the use of screening (table 1). The difference between screening and not screening is, therefore, regarded as a difference in the average amount of heterophoria that may be uncovered, and the average change is such that more esophoria and less exophoria are uncovered when screening is used.

A more complete statistical analysis of the data of this study has been reported previously.³⁴

Considering anatomic factors alone, the two eyes should be divergent, but in the

absence of pathologic change, except in deep sleep or narcosis, the eyes never diverge but always converge in varying degrees. This convergence is the result of a constant convergence innervation arising from the convergence center (nucleus of Perlia). The presentation of dissimilar images of the same object to the two eyes by using a Maddox rod dissociates the eyes only partially, and the convergence center is thrown out of balance by a comparable amount. The addition of screening to the Maddox-rod test produces further and greater upset of the convergence innervation arising from the convergence center. The monocular-fixation reflex is still acting powerfully, since only one eye is being screened, and the convergence center in an attempt to correct for this added imbalance responds with even more convergence innervation. The result should be—and is—increased esophoria or decreased exophoria, depending upon which of the two was present from the beginning.

THE ELASTICITY THEORY

The results of the experiment on measuring heterophoria, using a Maddox rod with and without screening, require a re-examination of the vergence mechanism. The results cannot easily be explained by the concept of two vergence centers. Another concept, requiring only one vergence center and compatible with other facts of ocular function, is needed. The elasticity theory of ocular divergence is such a concept.

The fact that pure convergence needs an antagonist in the sense of a movement in the opposite direction is obvious. This antagonistic force may be called "divergence," since the term is a familiar one. Duane's⁴ definition of divergence as that function by virtue of which the visual lines, when converged on a near object, are made to separate in order to sight a

more remote object, is acceptable. This definition may be accepted and yet imply nothing about the origin of the divergence function.

Haessler³⁵ states that one must distinguish the action of diverging from divergence conceived of as a well-established functional unit of the binocular neuromuscular system for whose performance an anatomic structure exists in the brain. In other words, recognize divergence as a movement but be careful to what source you attribute its production. He states that it is not at all necessary to assume that such a functional unit for divergence exists. Faith in the existence of divergence as an independent function, says Haessler, is increased by habitually thinking of convergence and divergence in terms of an oversimplified scheme of opposing forces acting only in a horizontal plane. When a more complex movement is considered, such as carrying the eyes up and out, the accomplishment of a final precise adjustment by means of the same simple stimulus to divergence as is active in a horizontal plane is hardly imaginable because the 12 extraocular muscles would have to be stimulated and inhibited in entirely different proportions.

Any factor short of an actual center for divergence which would logically explain all of the observed phenomena of divergence should be acceptable, particularly since no divergence center has ever been demonstrated. If divergence is innervational in origin and hence active, then a center for divergence is most certainly indicated. If, on the other hand, divergence is passive, one must offer an explanation of how this could possibly be. Let us, therefore, assume that divergence is entirely passive in the sense of there being no divergence innervation, and that it occurs only passively in the sense that it is solely a result of elasticity of the

orbital structure, and then consider the available facts to see whether such an assumption is warranted from the standpoint of anatomy and physiology.

Anatomic. A consideration of the position of the eyes relative to each other, taking into account only the structure of the orbits and their contents, points to a state of divergence of the visual lines. The medial orbital walls are roughly parallel and both parallel the sagittal plane of the head.³⁶ The lateral orbital walls, on the other hand, make an angle of almost 90 degrees with each other or one of 45 degrees with their respective medial walls. Thus each orbital axis makes an angle of roughly 23 to 25 degrees with the sagittal plane of the head. The axis of the muscle cone within the orbit just about coincides with the orbital axis and hence it also makes approximately a 25-degree angle with the sagittal plane of the head. The four recti muscles are all about 40 mm. in length and all take origin from the annulus of Zinn about the optic foramen at the orbital apex.

Thomson³⁷ said "... the eyes lie in an anatomically divergent position—the cadaveric position." Similarly, Chavasse³⁸ "... the anatomical position of the eyes—the position of absolute or dead rest—is one of divergence associated with some sursumvergence."

From the standpoint of orbital structure alone, the eyes should assume at all times a position of divergence of the visual lines. The fact that they never do this in the absence of pathologic change, except in deep sleep or narcosis, simply means that the reason for the lack of divergence is the existence of some antagonistic force which cannot be explained on structural grounds alone.

Physiologic. The first question that must be asked is this: Are the extraocular muscles strong enough to produce true

divergence of the visual lines (or convergence either, for that matter), *if properly innervated?* Lancaster¹⁰ has answered this question quite definitely. He has shown that each of the extraocular muscles should have a maximum strength of 750 to 1,000 gm., provided all the fibers contract at once. The amplitude of excursion—the amount of shortening that can occur when a muscle contracts—is about one half to one third of its length; that is, a muscle 40 mm. long could shorten 13 mm. or more. In the eye, a 13-mm. shortening of one muscle would result in a rotation of over 65 degrees of arc, yet the eyes are capable of only 40 to 50 degrees of rotation from the primary position.

Lancaster¹⁰ and Kennelly³⁹ estimated the force required to rotate the eyeball as being 1.00 to 1.75 gm., neglecting friction, and estimating the weight of the eye as 8.0 gm., and its size as 24 mm. in diameter. Even when making liberal allowance for the extra weight and drag of the optic and ciliary nerves, the arteries and vortex veins, the conjunctiva, fascia, and fat, they believed it reasonable to assume that a pull of 5.0 gm. is entirely sufficient to move the eye at its observed velocity. This means that the extraocular muscles are powerful enough, *if properly innervated*, to exert a pull 100 times the amount needed to move the eye. Probably less than 5 percent of the fibers are made to contract at any one time. If proper innervation is available from either a convergence or a divergence center, certainly the extraocular muscles are strong enough many times over to produce adequate movements of divergence and convergence. But during consciousness the eyes never diverge in the absence of any pathologic lesion. It is obvious that at no time when binocular vision is in use can the visual axes diverge.¹⁴ From the standpoint of function, therefore,

there is no necessity to assume a center for pure divergence.

What then are the tenets of the elasticity theory? In the absence of any innervation (as in deep sleep or narcosis), there is divergence of the visual lines which is solely the result of the elastic pull of the orbital structure. When consciousness supervenes and the eyes are opened, the convergence innervation arising from the convergence center is called into play and fixation is accomplished. Varying amounts of convergence innervation result in varying degrees of convergence; when it is desired to shift the gaze from a near object to a remote one, the degree of convergence is lessened by a proportionate decrease in the convergence innervation. Since the elastic divergent pull of the orbital structure is constantly present, a decrease of the convergence innervation allows the elastic divergent pull to act passively but nevertheless effectively, and the visual lines are thus made to converge less, fixating the more remote object. This is the elasticity theory and it is not a new one. Berry⁴⁰ stated that divergence was essentially an inhibition of convergence. Stutterheim⁴¹ called the anatomic position of rest one of passive divergence due to elasticity, with the eye held there by anatomic structures; he said that the extrinsic muscles acted as tensors—"... they act by contraction in the direction away from the primary position" (his "primary position" is the same as the anatomic position of rest of other writers). He continues "... *in the direction towards the primary position, they act by inhibition alone*" (the italics are his).

DISCUSSION

For purposes of clarity, it should be restated that two concepts of divergence exist. One might be considered "true" divergence, a condition wherein the visual

lines of the two eyes actually diverge and for that reason would cross each other only if prolonged backward through the eyeballs. The other concept of divergence (Duane's) is called negative convergence by many and is a process wherein the visual lines of the two eyes are made to converge less. The crux of the matter lies, of course, in the mechanism behind the production of the two types of divergence.

Anatomically, in the absence of any innervation at all, the two eyes should diverge from each other by virtue of the elastic pull of the orbital structures. Physiologically, the extraocular muscles possess many times enough power to produce either divergence, convergence, or any conjugate movement if properly innervated. Yet, in the conscious state in the absence of a pathologic process, true voluntary divergence has never been proved to exist. The elastic divergent tendencies of the orbital structure must be combated by some force, since true divergence does not occur in consciousness. The force involved is obviously that of convergence innervation from a convergence center, which has been demonstrated both anatomically and physiologically by Bender and Weinstein.³ Assume for the moment that there is no divergence center and no active divergence. It still seems important to elicit an antagonist for the convergence innervation known to exist.

The "force" of convergence pulling against the "spring" of elasticity inherent in the orbital structures and tending toward divergence satisfies the requirement of an antagonist for the convergence innervation. If this assumption is tentatively accepted as correct, an analogy to a spring scale is quite striking. If no pull (force) is exerted on a spring scale, it will read zero; similarly, if no convergent pull, resulting from convergence innervation of the extraocular muscles, is

exerted on the eyeballs, they diverge in what might be called the zero position (as they do in deep sleep or narcosis). When pull is exerted on a spring scale, the reading varies from zero depending upon the force of the pull and continues to stay away from zero until the pull is released; it then returns to zero (the resting position of the spring scale). If the pull resulting from convergence innervation is exerted on the eyeballs via the extraocular muscles, they leave their divergent position (zero position) by an amount proportional to the convergent force exerted and stay away from that position until the pull is removed (in deep sleep or narcosis); they then return to their zero position of divergence. This theory of the production of divergence by elasticity of the orbital structures alone is not new,^{40,41} and Bruce² referred to it as "... elasticity in divergence." The evidence in support of the elasticity theory of divergence comes from several sources.

1. When an eye is blinded by trauma, exotropia is an almost invariable result. The passive elastic divergent effect of the orbital structure is being exerted. Nevertheless, even with fusion completely disrupted, the fixation reflex (monocular)¹² will cause the angle of squint to vary from time to time as the convergence innervation varies. This is a commonly observed clinical phenomenon.

2. Bell's phenomenon, probably for protection of the eyes during sleep, also indicates strongly that when fusion is completely disrupted and the monocular-fixation reflex is obliterated as well, any convergence innervation is at a minimum and elastic divergence occurs, in addition to elevation of the globes.

3. Bielschowsky¹¹ cites a case of a patient with complete bilateral paralysis of the sixth cranial nerves who habitually kept his chin pressed against his chest. This position (eyes elevated in relation to

their respective orbits) enabled the patient to secure binocular single vision because elastic divergence of the orbital structure could more easily act in this position in spite of complete sixth-cranial-nerve paralysis, which meant, in turn, complete loss of any possible divergence innervation from a divergence center.

4. Although admitting that "divergence paralysis" might easily be convergence spasm, Bielschowsky¹¹ nevertheless lists seven characteristic findings in the former entity. Of the seven, only one (the fourth) appears to offer any difficulty of explanation on the basis of convergence spasm. "... when an object is brought nearer to the eyes than the point at which no diplopia exists, insufficient convergence may produce a crossed diplopia." How could insufficient convergence be present if there is a convergence spasm? Bielschowsky himself affords the answer "... the idea of convergence spasm superimposed upon, or together with, a convergence weakness is by no means unusual—a peculiarity seen especially in neurasthenia, an important characteristic of which is the combination of increased irritability and abnormal exhaustibility."

5. In total ophthalmoplegia, the eyes rarely look straight ahead in a parallel direction but usually diverge slightly, and very exceptionally converge.⁴²

6. Exophoria is the almost invariable finding after prolonged occlusion.¹⁴

7. Characteristic of cases of "divergence paralysis" is the fact that they suddenly develop into bilateral sixth-cranial-nerve paralyses.¹¹ Bruce's² reasoning indicates the probable location of a divergence center as the midline. The sixth-cranial-nerve nuclei, however, are not in the midline.^{3, 43, 44, 45} Bielschowsky¹¹ offers the explanation that in "divergence paralysis," the lesion is supranuclear in location, then spreads to involve the sixth-cranial-nerve nuclei, and thus pro-

duces bilateral sixth-nerve paralysis. If Bielschowsky's explanation is correct, the divergence center could not lie in the midline; if it did, it would be an amazing coincidence that a supranuclear lesion of the divergence center would spread laterally with such symmetry as to involve both sixth-cranial-nerve nuclei simultaneously! Yet all Bruce's work indicates that if a divergence center exists, it probably lies in the midline.

8. If divergence and convergence are separate entities, produced by separate centers, then exophoria and esophoria should also be separate and independent of each other. It is agreed that the more successful a test is in disrupting fusion, the more heterophoria that test will uncover. The addition of screening to the Maddox-rod test provides greater disruption of fusion than the use of the Maddox rod alone. The addition of screening to the Maddox-rod test, therefore, should elicit more esophoria or more exophoria, whichever the case might be, than the test without screening. Instead, the addition of screening and the consequent greater disruption of fusion elicits more esophoria and less exophoria. Exophoria and esophoria appear not as separate entities but rather are interdependent, one upon the other, and actually represent varying degrees of the same thing. This is understandable only when a convergence center exists alone, and there is no divergence center.

Haessler³⁵ has wisely cautioned that the matter is a biologic problem. In biology the emphasis is necessarily on empiric observation, and explanatory patterns must be adopted cautiously and tentatively, with full realization that they

must be constantly revised as fresh evidence is elicited. Until a divergence center is demonstrated anatomically, or until more convincing evidence of its existence is forthcoming, the elasticity theory of divergence as a passive antagonist to active convergence seems to offer a satisfactory explanation of all observed phenomena.

SUMMARY

Although the existence of a center in the brain for ocular convergence is well established, the evidence for the existence of a separate center for ocular divergence is not convincing. The arguments for a divergence center fall into three subdivisions: (1) phylogenetic—divergence must have developed as an antagonist of convergence; (2) physiologic—divergence is an active process and hence must have its own innervational center; and (3) pathologic—since "divergence paralysis" is recognized, it must be caused by a lesion in the divergence center.

When the Maddox-rod test of heterophoria is performed with and without screening and the results compared statistically, the addition of screening is found to elicit more esophoria and less exophoria. This is construed as evidence for a single vergence center (convergence), since exophoria and esophoria behave not as independent entities but rather as varying degrees of the same entity.

The theory of passive divergence due to elasticity of the orbital structure is reviewed and further clinical evidence is put forward to substantiate it. It would thus seem that the majority of phenomena can be adequately explained on the basis of a single vergence center in the brain (a convergence center).

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PERIARTERITIS NODOSA WITH INVOLVEMENT OF THE CHOROIDAL AND RETINAL ARTERIES*

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The following case of periarteritis nodosa is being reported because the diagnosis was made during life, after ophthalmoscopic examination, in conjunction with the clinical history and the physical findings. A fusiform aneurysm of the inferior temporal artery of the fundus of the right eye was the most important finding and aided greatly in establishing the diagnosis of periarteritis nodosa. This will be discussed more fully in a later section.

The detection of this strange malady has seldom been made during life and then it has been more or less accidental. Because of its protean character and bizarre manifestations, it can simulate any one of the many ordinary clinical entities. The abdominal distress of which so many of the patients complain is due to vascular involvement of the various organs within the peritoneal cavity. Several exploratory laparotomies have been performed for just such surgical emergencies and the findings obtained revealed the characteristic pathologic processes of periarteritis nodosa.¹

This disease entity was first accurately described by Kussmaul and Maier² in 1866 as a definite inflammatory disease involving the medium and small arteries. Since then, this relatively rare disease has been reported at intervals until a fairly voluminous literature has accumulated on the subject, containing reports of extremely varied clinical manifestations.

The appearance of gross aneurysmal dilatations of the arteries to which the

syndrome owes its name is not the essential characteristic.³ The pathologic changes consist of a nonsuppurative inflammation beginning in the outer portion of the medium and small arteries and are accompanied by a fibrinoid degeneration of the media which secondarily involves the intima. The primary locus of origin of the necrotizing process in the arteries has not been established. There is extensive vascular and perivascular infiltration with polymorphonuclear neutrophils, eosinophils, and to a lesser extent with lymphocytes. The smaller vessels become occluded if the process extends to the intima. Exudation, which is followed later by necrosis, results in the formation of aneurysm and thrombosis. Only rarely has marked involvement of the veins been noted.⁴ The etiologic factor of periarteritis nodosa has long been veiled in obscurity. The streptococcus has been considered more frequently than any other organism, although syphilis has been offered by several writers as a strong possibility. The poor response to anti-luetic treatment and the inability to find the spirochete dismiss syphilis as a possible cause. Other concepts which have received wide speculation are: a filterable virus,⁵ a variety of different infections, disease of the central nervous system, and toxic injuries to the vessel wall. Only recently has there been any suggestive experimental evidence offered along the lines of hypersensitivity as a possible factor in the causation of this necrotizing vascular disease. Rich and Gregory⁶ have produced in rabbits, by experimental means, pathologic lesions resembling

* Read before the medical staff, Battey General Hospital, Rome, Georgia, May 21, 1945.

those of periarteritis nodosa in man, as a result of an anaphylactic type of hypersensitivity following foreign sera and sulfonamide administration.

This disease has no age incidence since cases have been reported in infancy and in the aged. Fifty percent of the cases occurred between the ages of 20 and 40 years.⁷

The clinical course consists usually of a chronic sepsis, marked emaciation, weakness, anemia, and a long-continued, low-grade, septic temperature curve. This disease is characterized by a multiplicity of clinical and laboratory findings, since the arterial system of a set of organs is invariably involved. As the necrotizing process subsides in one organ, it may manifest itself in another, thus demonstrating that the disease is punctuated with remissions and relapses. The preceding mechanism can thus account for the so-called healed stages of periarteritis nodosa.⁸ Since there is some tendency to remission and even apparent recovery in the severe and recognized cases, it is possible that many mild cases exist and go on to spontaneous recovery unrecognized. One can render the bewildering symptomatology of the disease less intricate by assuming the presence of an infectious process which, in addition to producing general disturbances such as fever, tachycardia, prostration, cutaneous eruptions, and leucocytosis, causes symptoms based on circulatory disturbances in the systems or regions affected.⁹

The treatment is principally symptomatic. Repeated small blood transfusions, liver, and iron have been employed to combat the severe anemia. Antiluetic therapy is of highly questionable value.

REPORT OF A CASE

A corporal in the United States Army, aged 43 years, developed an acute gonorrhea on March 2, 1943, in Natal, Brazil.

He was sent to the infirmary at Natal, and, after receiving 100 gm. of sulfathiazole was returned to duty as cured on April 2, 1943. One day, after his return to duty, the discharge reappeared, and he was given 100 gm. of sulfadiazine, with improvement. The urethral discharge, which recurred on three other occasions during a three-months' period, necessitated further hospitalization. He received an additional 32 gm. of sulfathiazole and 100,000 units of penicillin.

In view of the failure of this patient's urethral discharge to respond to the sulfonamides (total 232 grams) and penicillin therapy, he was evacuated to the United States, on October 21, 1943, and was admitted to the AAF Regional Station Hospital No. 1, Coral Gables, Florida. At this time, the patient complained of generalized muscular aching, weakness, a loss of 30 pounds within two-months, a daily fever over a period of one month, pain and swelling in the left ankle, and a return of nausea following meals, of which he had been complaining for several weeks. He also had had pain in the shoulder girdle which radiated to both arms and hands, as well as numbness and loss of grip in both hands for two months. The pain persisted in both upper extremities and then subsided, to be followed by paresthesia involving all the fingers of the left hand, and the thumb, index, and middle fingers of the right hand.

The patient was admitted to the Ream General Hospital on November 13, 1943, complaining chiefly of weakness, numbness, and paresthesia in all four extremities. He also had frequency of urination and nocturia. He was originally admitted to the Surgical Service, but in view of the extensive peripheral neuritis was transferred to the Medical Service. The family history was irrelevant. There was no history of any serious diseases prior to his present illness.

Physical findings. The patient weighed 131 pounds (59.5 kg.). He was pale and poorly nourished. The eyes, ears, nose, and throat were essentially normal. The heart and lungs were normal. There was slight swelling and tenderness of the left ankle, and also generalized depression of the deep reflexes, with weakness of all the extremities. The muscle tenderness was severe. The epicritic sensibilities were markedly diminished to almost absent in the distal portions of both the upper and lower extremities. The cranial nerves were intact. The blood pressure, which had always been 110 systolic and 70 diastolic during the past year, was 130 systolic and 80 diastolic at the time of admission.

On November 15, 1943, red blood cells numbered 3,320,000 with 59 percent hemoglobin. White blood cells numbered 7,250 with eosinophils 4 percent. Previously, on July 14, 1943, the blood revealed a 10-percent eosinophilia. The sedimentation rate was 27 mm. The blood Kahn reaction was negative. This test, which was performed on three other occasions, was always reported as negative. The urine was negative for albumin, but microscopic examination revealed the presence of a few pus cells. Previous urine specimens at other hospitals had been essentially normal, except for pus cells, which were present in moderate degree, during the gonorrheal exacerbations. Several X-ray films of the chest were negative. The feces was negative for ova and parasites. Cholesterol was 168 mg. per 100 c.c. of blood. The total blood proteins were 6.2 percent. The nonprotein nitrogen was 24 mg., creatinin, 1.4 mg., and sugar, 66 mg. Urethral smears were negative for gonococci at the time of admission, although the 194th Station Hospital reported gram-negative extracellular diplococci, with many pus cells, on July 12, 1943. Lumbar puncture on two occasions revealed a normal spinal fluid under nor-

mal pressure. *Staphylococcus albus* was grown from a urine culture.

The patient was placed on a high caloric, soft diet with large doses of all the vitamins, especially thiamin chloride and B-complex. Intramuscular liver injections were administered as well as iron and general supportive treatment. In addition, the patient was given physiotherapy daily for his peripheral neuritis in an effort to maintain muscle tone. The patient improved initially, but subsequently went on to several remissions and relapses. On November 26, 1943, the blood showed white cells, 10,200 with eosinophils 6 percent. Urinalyses during January and February, 1944, showed a moderate trace of albumin, many bacteria, few finely granular casts and an average of two pus cells and one red cell, microscopically. Repeated urethral smears were negative for gonococci. Nausea following meals was a constant complaint, and on December 6, 1943, a gastrointestinal series and a gastric analysis were performed, revealing no evidence of organic pathologic change. The patient complained of frequency of urination and nocturia, but the diagnosis of pyelonephritis or cystitis could not be substantiated. Lumbar puncture on January 4, 1944, showed a normal spinal fluid under normal pressure.

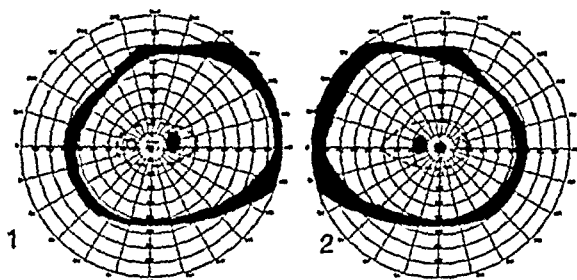
Ocular examination. On January 31, 1944, the patient stated that his vision had become blurred for the first time. Eye consultation on February 1, 1944, revealed the following findings: Vision, O.D. 20/200, O.S. 20/100 uncorrected; O.D. 20/50—3 with +2.00D. sph. \approx —0.50D. cyl. ax. 90°; O.S. 20/50—1 with +2.00D. sph. \approx —0.75D. cyl. ax. 90°. Associated parallel movements were full in all cardinal directions. Absolute central scotomas were present in both eyes, with bilateral enlargement of the blind spot (figs. 1 and 2). The pupils

were round and regular and reacted sluggishly to light and fairly to accommodation. Intraocular pressure was within normal limits by finger palpation. The cornea, lens, and vitreous were clear in both eyes.

Fundus, O.D. The disc margins were completely blurred, and the color of the disc very hyperemic (fig. 3). The disc was elevated about 0.5 to 1 diopter. The details of the cup were barely discernible. There were six fresh linear hemorrhages

few hemorrhages and exudates were seen in the periphery.

Fundus, O.S. The disc margins were completely blurred and the disc was elevated about 0.5 to 1 diopter, and markedly hyperemic (fig. 4). Four linear hemorrhages were seen on the summit of the disc. Very few hemorrhages were seen in the retina. A number of soft exudates surrounded the periphery of the elevated papilla. There were no aneurysmal dilations. The arterial changes were similar



Figs. 1 and 2 (Goldsmith). Visual fields on January 31, 1944. Fig. 1, O.D. Enlarged blind spot; absolute central scotomas for red and white. Vision 20/200 correctable to 20/50-3. Targets, white and red 2/330 and 5/330. --- = red.

Fig. 2, O.S. Enlarged blind spot; absolute central scotomas for red and white (smaller than in O.D.). Vision 20/100 correctable to 20/50-1. Targets as in figure 1.

and several faint exudates scattered in the superficial loose tissue of the elevated papilla. The periphery of the disc was striated radially and blended imperceptibly with the flat retina. Several fresh linear and round hemorrhages were studded through the posterior pole of the fundus. The exudates were soft and blended with the surrounding retina. The arterial tree showed moderate damage. About one disc diameter away, along the course of the inferior temporal artery, a fusiform type of aneurysmal dilatation replaced the artery for a distance slightly less than one disc diameter. The margins of the aneurysm were clearly delineated. The arteries showed moderate changes in caliber (probably angiospastic in origin) and in many places were obliterated so that one could barely make out the vessel walls. There was slight arteriovenous constriction. The veins appeared congested. Several of the linear hemorrhages were white-centered. The fovea was intact. A

to those seen in the right eye. The veins were congested, and the arteriovenous constriction appeared slight. The periphery was within normal limits.

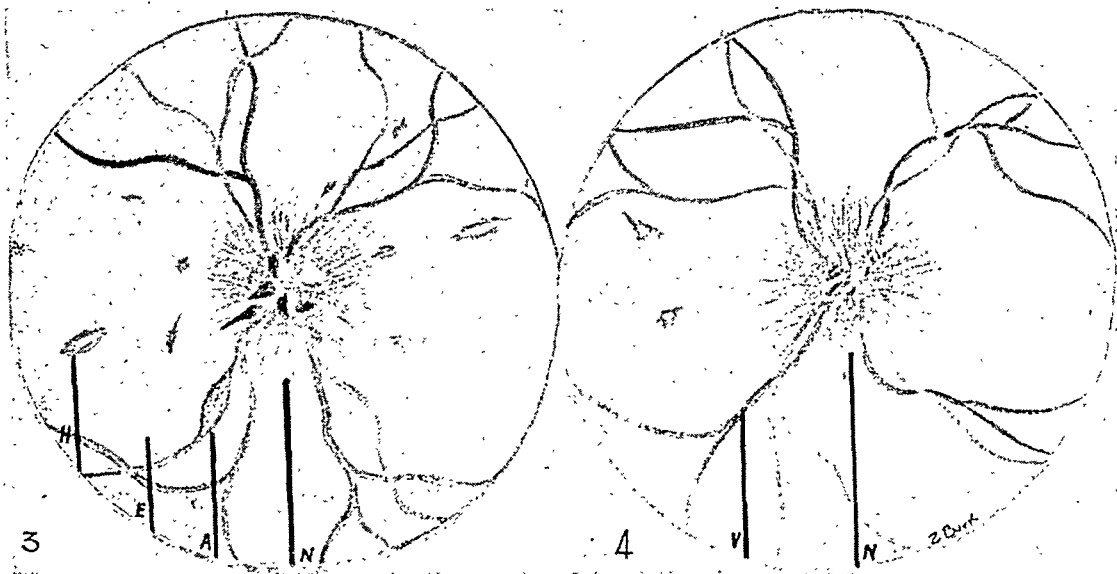
Diagnosis: (1) Neuroretinitis, bilateral, with aneurysm of the right inferior temporal artery, due to periarteritis nodosa; (2) generalized periarteritis nodosa; (3) lupus erythematosus disseminatus.

It was suggested that the patient be given repeated, small blood transfusions to combat the severe secondary anemia. Several fresh hemorrhages and exudates were observed in both fundi on February 4, 1944. There had been no further increase in the elevation of either disc. It was suggested that a biopsy specimen be taken from muscle to rule out periarteritis nodosa. Repeated blood-pressure readings never exceeded 150 systolic and 100 diastolic. The patient had been running a febrile course, ranging between 98° and 102°F., over a period of four months.

Despite this, the patient's general condition appeared unchanged during this time. No fresh hemorrhages nor exudates were noted on February 12, 1944. No further elevation of the discs was observed. This was a case of bilateral optic neuritis and was not due to an expanding intracranial lesion. The patient had been constipated since admission. On February 15, 1944, a

male, with an estimated weight of 105 lbs. (47.7 kg.). The muscles showed moderate wasting. There was no urethral discharge.

The right pleural cavity was largely obliterated by diffuse adhesions. The lower lobes of both lungs were congested. Pulmonary vessels, large and medium bronchi showed no obstruction. The peri-



Figs. 3 and 4 (Goldsmith). Fig. 3, Fundus O.D. A, fusiform aneurysm of the inferior temporal artery; N, optic neuritis with 0.5 to 1 diopter elevation; H, hemorrhage, several white-centered; E, exudate; marked angiospasm of retinal arteries; slight arteriovenous constriction.

Fig. 4, Fundus O.S. N, optic neuritis associated with hemorrhages and exudates; V, veins congested; angiospastic retinal arteries.

second lumbar puncture was performed. The fluid was normal except for an early rise in the colloidal gold curve. The pressure was not increased. The patient suddenly developed nausea, vomiting, and stupor on February 16, 1944. This was followed by generalized convulsions and death. The patient was pronounced dead at 1850 hours (6:50 P.M.). No biopsy specimen had been taken from a muscle *intra vitam*.

Postmortem examination (Homer H. Hunt, Capt.). The body was that of a markedly emaciated middle-aged, white

cardium contained 50 c.c. of clear, straw-colored fluid. The right ventricle was soft and flaccid. No evidence of vegetations was present. The coronary vessels were soft and collapsed and showed no thrombi. The intima of the aorta had a slight yellowish discoloration. The thymus was atrophic. The capsule of the spleen was wrinkled and the parenchyma was soft, reddish brown, and scraped easily. The liver appeared normal. There were small grayish areas in the periadrenal, fatty tissues. The middle portion of the appendix was slightly constricted and hemorrhagic. There were depressed,



Fig. 5 (Goldsmith). Small artery in the epicardial fatty tissue demonstrating F, fibrinoid degeneration; intimal proliferation; L, leucocytic infiltration (polymorphonuclear neutrophils, lymphocytes, plasma cells, and eosinophils) into the adventitia, media, and intima; P, perivascular infiltration.

dark-red areas and recent small hemorrhages in the cortex near the upper pole of the left kidney; the right kidney was normal. The pelvis and ureter of both kidneys were normal. The right testicle was small and was yellowish on section. The brain and cord was normal grossly and on cut sections. The left middle ear showed a soft, glairy yellowish-brown material in the region of the medial mastoid cells. There were patches resembling old hemorrhage throughout the length of the petrous portion of the temporal bone.¹⁰

Microscopic examination. The arteries of all the viscera, especially those of the heart, kidneys, pancreas, appendix and liver, showed a focal periarteritis characterized by fibrinoid necrosis of the media with a tendency to aneurysmal formation. This inflammatory process was observed in different stages. Early stages were characterized by an abundant perivascular infiltration of lymphocytes, polymorphonuclear neutrophils, occasional plasma cells, and eosinophils. The infiltrate formed dense cuffs and extended into

the adventitia. The media appeared frayed, edematous, and was also infiltrated with leucocytes, as seen in one of the vessels in the epicardial fatty tissue (fig. 5). Later changes, as in the kidney, showed the media undergoing fibrinoid necrosis, usually involving the entire circumference of the vessel. The intima demonstrated proliferation of the endothelium as well as subendothelial proliferation of new connective tissue infiltrated with leucocytes. Following medial necrosis, aneurysmal formation by stretching of the necrotizing tissue was not unusual, and in one instance the aneurysmal dilatation of the pancreatic artery showed recent perforation with hemorrhage into the surrounding tissue (fig. 6). In some instances, as in the appendix, active inflammation was inconspicuous whereas the vessel wall showed very marked fibrous thickening of all coats, with organized occlusive thrombosis (fig. 7). The smaller arteries and veins as well as the arterioles and venules frequently showed perivascular infiltration of lymphocytes and polymorphonuclear neutrophils, although thrombosis was unusual (fig. 8).

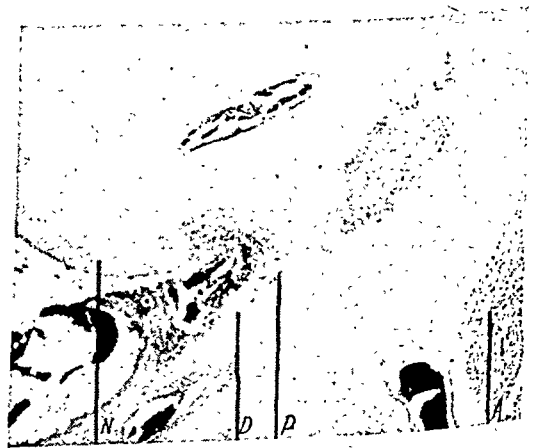


Fig. 6 (Goldsmith). Large pancreatic artery. Marked necrotizing arteritis (N), with aneurysmal dilatation (D), and recent perforation at this point (P); the pancreatic acini, A, appear compressed and show early degenerative changes in several places.

A detailed description of additional changes in the kidney would not be amiss at this time (fig. 9). Section showed marked vascular changes in all stages as afore described; however, many vessels appeared essentially normal. For the most part the glomeruli appeared normally cellular and blood-filled. Here and there, in relation to the vascular damage, glomeruli showed degenerative changes varying from increased cellularity, ischemia, and crescent formation in the capsule to complete hyaline necrosis. Interstitial infiltration of lymphocytes and fewer polymorphonuclear neutrophils surrounded these areas. In areas throughout the pyramids, marked interstitial leucocytic infiltration was present with fibroblastic reaction and tubular degeneration. The parenchymal changes were incident to the vascular damage, previously described.

Microscopic diagnosis. Periarteritis nodosa, with involvement of the heart, spleen, kidneys, liver, lungs, and other viscera; peripheral neuritis, due to vascular involvement of the nerve sheaths and

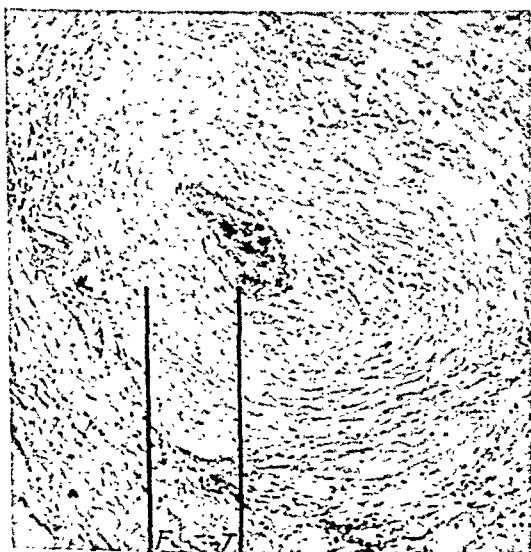


Fig. 7 (Goldsmith). Appendicular artery. Healed stage. Active inflammation inconspicuous. The vessel wall shows very marked F, fibrous thickening of all the coats; T, organized occlusive thrombosis.



Fig. 8 (Goldsmith). Peripheral nerve, showing early changes of periarteritis nodosa in the smaller arteries of the sheath. Advanced changes also were seen. C, perivascular cuffing and mild adventitial infiltration with polymorphonuclear neutrophils, eosinophils, and occasional plasma cells.

trunks; occlusive appendicitis, due to involvement of the appendicular artery; right fibrinous pleuritis.

The right eye was forwarded to the Army Medical Museum, and on June 1, 1944 the following report was received: Gross. The cornea is slightly cloudy due to fixation. There are retinal opacities posteriorly and edema at the macula.

Microscopic. On one side there is elastosis of the conjunctiva, and granular deposits are seen in the outer corneal lamellae at the limbus (fig. 10). The iris

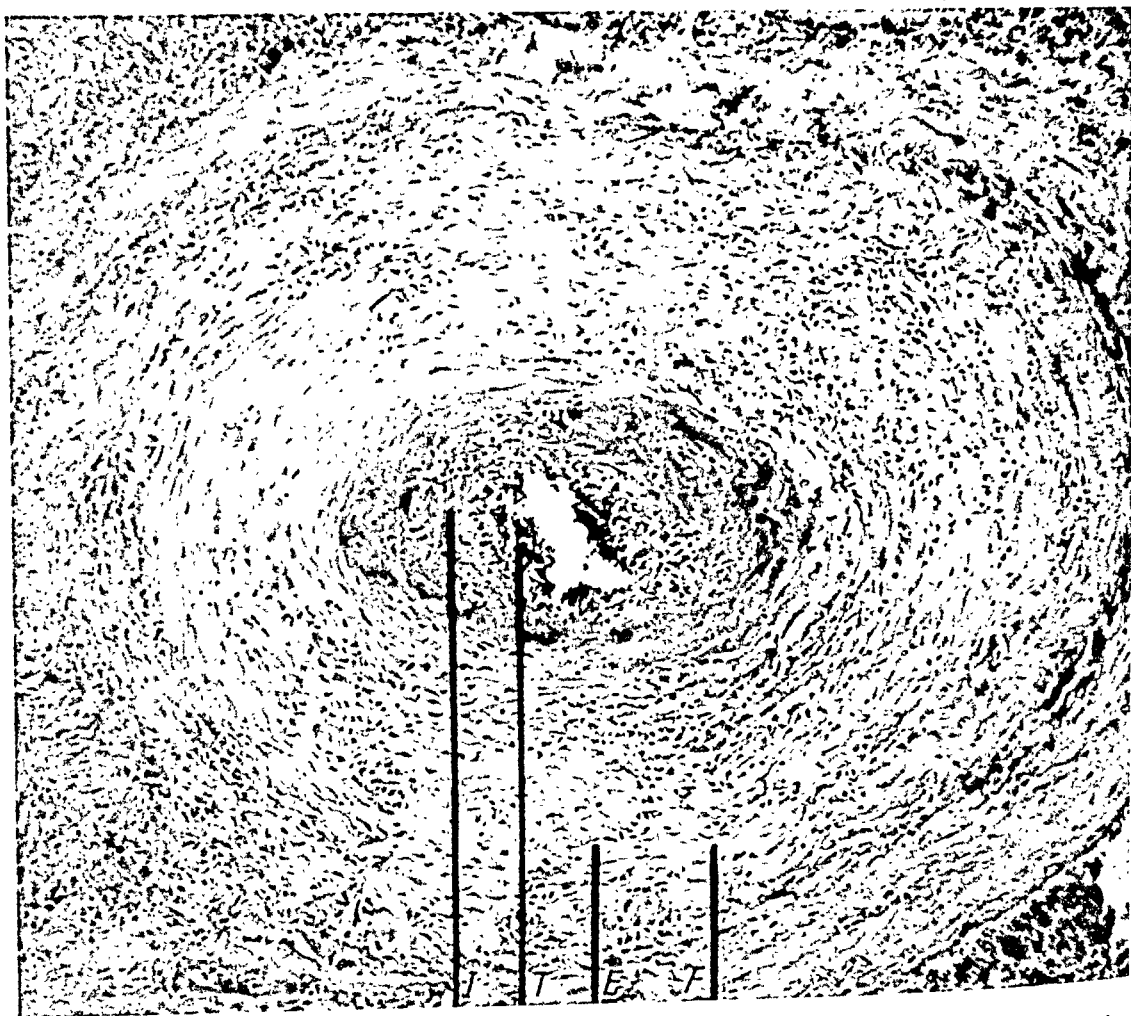


Fig. 9 (Goldsmith). Small renal artery. Moderately advanced stage. Media demonstrating fraying of smooth muscle fibers (F), edema (E), and fibrinoid necrosis; intimal and subendothelial hyperplasia (I) with incomplete thrombus formation (T); leucocytic infiltration (mainly lymphocytes) throughout the circumference of the vessel wall.

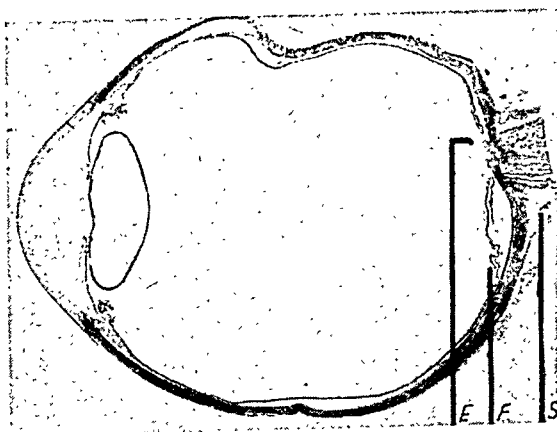


Fig. 10 (Goldsmith). Sagittal section, O.D. E, elevation of disc; retina partially detached by serous exudate; F, folding of retina in macular region; S, sclerotic changes in smaller orbital arteries.

appears somewhat edematous, with rarefaction of the cellular structure. There is slight vacuolization of its pigment epithelium. There are early degenerative changes in the cortical lens fibers. In the filtration angle, the iris root approximates the ligamentum pectinatum, without being actually adherent to it. The ciliary processes are edematous and somewhat hyalinized. There is serofibrinous and hemorrhagic detachment of the ciliary body and peripheral choroid. In the posterior choroid are focal areas of lymphocytic and large mononuclear cell infiltration around small arteries with greatly thickened walls which show hyalinization and fibrinoid

change. In these, the endothelial linings are somewhat proliferated and the lumina narrowed almost to the point of occlusion (figs. 11, 12). A number of the involved arteries show aneurysmal dilatations. The choroid is irregularly thickened by the inflammatory and vascular changes. The retina is partially detached, with serous exudate beneath it. It is folded in the macular region. Vascular changes in the retina are not marked, but hemorrhagic and serofibrinous exudates are present,

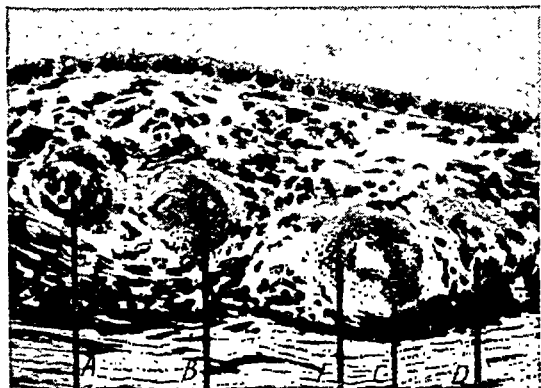


Fig. 11 (Goldsmith). Four choroidal arteries. A and D show early changes of periarteritis nodosa, fraying of the medial smooth-muscle fibers, and mild perivascular leucocytic infiltration; B, advanced stage, complete occlusive thrombosis; C, intimal and subendothelial proliferation with marked medial fibrinoid necrosis (F); choroidal thickening due to infiltration with many inflammatory cells.

particularly in the outer plexiform and nuclear layers (fig. 13). These are numerous posteriorly, especially in the macular region. There is some microcystic degeneration. The nerve head is somewhat edematous. The lamina cribrosa is not depressed. There are sclerotic changes in the smaller orbital arteries but without evidence of inflammation. Diagnosis: Periarteritis nodosa, choroid; papilledema; incipient cataract (Col. V. E. Ash, M.C., U.S.A., Curator).

COMMENT

Involvement of the retinal blood vessels

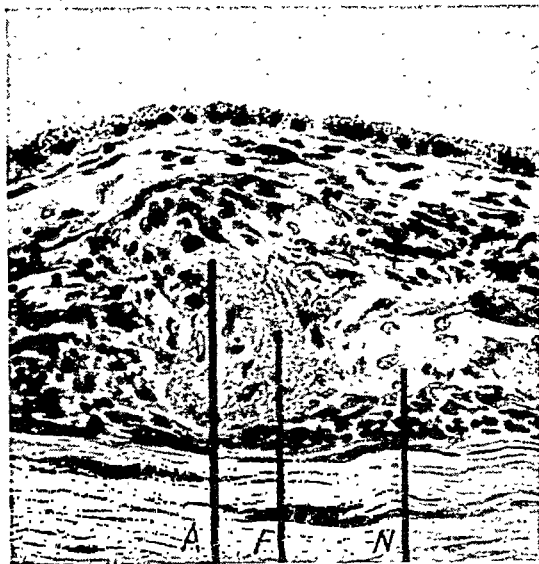


Fig. 12 (Goldsmith). Two choroidal arteries each demonstrating A, aneurysmal outpocketings; periadventitial and adventitial infiltration with lymphocytes, polymorphonuclear neutrophils, and occasional eosinophils and plasma cells; moderate fibrinoid necrosis (F), and endothelial proliferation with encroachment upon the lumen; N, marked necrotizing arteritis.

with the typical periarteritic nodules has been a very rare finding. In some 350 cases of periarteritis nodosa which have been collected and described in detail in the literature up to the present time, only four cases have been reported with histo-

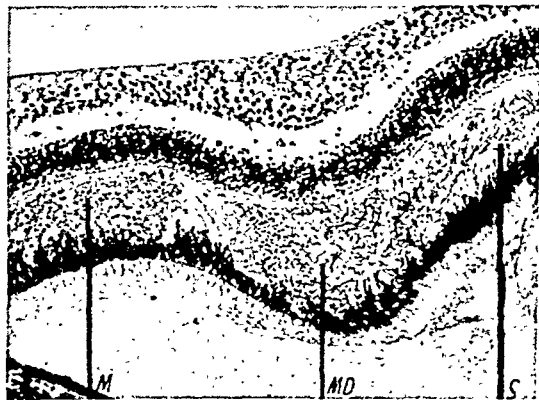


Fig. 13 (Goldsmith). Retina partially detached by serous exudate; MD, microcystic degeneration; and S, serofibrinous exudate into the internuclear plexiform layer; proliferation and migration (M) of pigmentary epithelium (E).

logic evidence of retinal arterial pathologic lesions.

Müller,¹¹ in 1899, was the first observer to note this rare pathologic picture. He described changes similar to those found in the small vessels in the brain. All degrees of blood-vessel disease could be made out. The earliest changes, beginning with leucocytic infiltration into the adventitia, were followed by a fibrinous exudation into the media, accompanied by necrosis. A certain amount of endothelial proliferation was present as well as retinal edema in the vicinity of the lesion.

Involvement of the central retinal artery with periarteritis nodosa was reported by v. Herrenschwand¹² and Böck.¹³ King,¹⁴ in 1935, reported a case in which there was intense generalized infiltration of the retina with lymphocytes and plasma cells accentuated in the periarterial regions, while the normal structure of the vessel walls was obliterated and endothelial proliferation was marked. This case was also associated with a transitory papilledema and a recurrent subacute uveitis which eventually led to enucleation because of a severe secondary glaucoma.¹⁵

There was a striking tendency toward aneurysmal formation in the case described in this paper. This vascular complication seemed to be a residual finding in a number of the involved arteries. The production of an aneurysm in periarteritis nodosa is an acute process and becomes established within a few weeks. The arterial wall from the adventitia to the intima is involved in an acute degeneration and inflammation. The aneurysms found in this necrotizing, arterial disease, can assume a variety of shapes ranging from saccular to fusiform. The histologic section, prepared at the Army Medical Museum from the right eye in the present

case, did not pass through the aneurysmal dilatation of the inferior temporal artery. This was most unfortunate, but it is hoped that such sections will be available following the war.

The arterial changes of periarteritis nodosa in the choroidal layer have been more frequently described than those in the retinal circulation. The first to demonstrate these pathologic changes were Christeller,¹⁶ Goldstein and Wexler,¹⁷ and Helpert and Trubek,¹⁸ in proved cases of endocarditis with multiple emboli. The last-named authors noted isolated, necrotizing lesions of the smaller arteries of the inner layer of the choroid in a patient who had gonorrheal urethritis.

King¹⁴ and v. Herrenschwand¹² also reported cases with the characteristic pathologic processes of periarteritis nodosa in the short ciliary arteries. A report of a young child with extensive ocular involvement was described in 1935 by Krahulick, Rosenthal, and Loughlin.¹⁹ This case demonstrated involvement of the anterior uvea with periarteritic nodules, as well as an episcleritis, orbital cellulitis, and arteritis of the choroidal vessels. An unusual case involving the vessels of the extraocular muscles without bulbar participation was described by Tertsch²⁰ in 1935.

In reviewing the literature, it was found, that no cases of periarteritis nodosa were ever diagnosed originally by fundusoscopic examination. This is readily conceivable, since approximately 81 percent of all the cases of periarteritis nodosa showed no pathologic changes of the fundi, whereas the remaining 19 percent invariably demonstrated, ophthalmoscopically the different stages of angiospastic retinitis.

The neuroretinitis, as described in the present case, was due principally to a severe toxic state. Superimposed on this

original fundus picture, one was able to observe ophthalmoscopically, incipient angiospastic arterial changes which were probably initiated by the mild hypertension due to slight renal damage. These organic changes in the kidney were due to the periarteritic, necrotizing process of some of the smaller renal arteries and were not primary in origin. It has been noted that renal involvement has occurred in 80 percent of all periarteritic cases.²¹ The clinical history, the ushering in of a mild hypertension late in the course of the disease, the moderate urinary findings, the normal blood chemistry, and the slight microscopic changes of the involved kidneys excluded the possibility of a malignant hypertension. The fatal termination was cerebral and not renal in character.

Goldstein and Wexler¹⁷ stated that on fundusoscopic examination the choroidal periarteritic nodules might reveal themselves in the retina as scattered whitish foci. Friedenwald and Rones²² observed rounded yellow elevations underneath the retina. They claimed that these elevations corresponded histologically to the periarteritic nodules in the choroid.

An interesting concept was recently postulated by Rich and Gregory⁶ on the basis of allergy. These authors stated that to continue administration of sulfonamides after a hypersensitive reaction has occurred may increase the danger of producing vascular damage such as is seen in periarteritis nodosa by prolonging the contact of the sensitized body with the offending antigen. The patient in this present report, who had received five courses of sulfonamides (a total of 232 grams) over a period of four months, might well fit into this category.

That the syndrome of periarteritis is usually superimposed on infectious or septic states has been known to many authors.^{18, 23, 24} These septic states act as the

prodromal illness and, after persisting for short intervals of time, are followed by a train of different symptoms which represent the initial necrotizing process of periarteritis nodosa. Thus we can readily conceive of the possibilities of initiating disease processes by creating hyperergic states within the septic host, by the indiscriminate and excessive use of such medicaments as the sulfonamides, the various sera and vaccines, and the many, newly arrived chemotherapeutic marvels.

Since the exact biochemical and immunologic reactions of these drugs are so complex and so little understood, great caution should be employed in their use in medicine. It is still unknown whether these drugs exercise deleterious or ameliorating effects on human tissue when administered over long periods of time. Continued experimentations along these lines are necessary before sound scientific facts can be established.

SUMMARY

1. Periarteritis nodosa with respect to its etiology, incidence, clinical course, diagnosis, prognosis, and treatment is briefly discussed.

2. A case of periarteritis nodosa is reported, with necropsy findings.

3. This syndrome was diagnosed for the first time *intra vitam*, by ophthalmoscopic observation in conjunction with physical findings and clinical course.

4. An aneurysmal dilatation of the fusiform type was observed in the fundus of the right eye involving the inferior temporal artery.

5. Other ocular findings of periarteritis nodosa are described.

6. The possibility of inducing hyperergic states within the human body by sulfonamides and sera administration is discussed.

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FURTHER STUDIES ON THE USE OF FURMETHIDE IN THE TREATMENT OF GLAUCOMA*

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In a previous paper one of us¹ (E. U. O.) has called attention to the favorable effect of furmethide in the treatment of primary glaucoma. The chemical relation of furmethide (furfuryl-trimethyl ammonium iodide) to other choline derivatives with parasympathomimetic action was discussed and its ocular pharmacology reviewed. Furmethide was found to be effective in reducing the intraocular pressure in primary glaucoma, both congestive and noncongestive. A 10-percent solution of furmethide appeared to be preferable to the synergistic use of a 20-percent solution of mecholyl and a 5-percent solution of prostigmine in the treatment of late cases of primary glaucoma.

Since the time of the first report our experiences with this miotic have been considerably amplified. It has been used in a large number of out-patients and in 65 additional hospital patients in the Wilmer Institute. The records of the out-patients are in many instances incomplete and therefore impossible of exact analysis. However, the same highly favorable action and absence of untoward reactions were noted in both groups. In this paper we are reporting the hospital cases only. These 65 cases together with the 41 cases previously reported give a total of 106 cases for analysis. The immediate reason for this further report is that the high therapeutic value of this drug and its freedom from toxic or local irritative reactions do not appear to be widely known among ophthalmologists, and there is some dan-

ger that the drug may not become available commercially.

TREATMENT OF PRIMARY GLAUCOMA

As is evident from the tables, furmethide was found to be equally efficacious in the congestive and noncongestive glaucomas. They are therefore reported together. The 65 cases in this analysis are those of patients with primary glaucoma whose intraocular pressure before therapy exceeded 40 mm. Hg (Schiotz). All of these patients were admitted to the wards of the hospital. One drop of a 10-percent solution of furmethide was instilled into the conjunctival sac every 15 minutes for two hours, then every three hours until the ocular tension was reduced to normal or until an operation was performed. The results are summarized in table 1. In the primary group, as a whole, furmethide reduced the tension to 35 mm. or less in 77 percent of the patients.

Tension before therapy was begun was over 55 mm. in 62 percent of the patients, and between 40 and 55 mm. in 38 percent. The tension was reduced to 35 mm. or less in 75 percent of the patients whose initial tension was over 55 mm. and in 80 percent of the patients whose initial tension was between 40 and 55 mm.

Early and late cases. The patients can also be divided into two groups; namely, those with early or late glaucoma. Early cases of glaucoma are arbitrarily considered to be those in which the field defect was less than 30 degrees in any meridian and the blind spot not enlarged more than 10 degrees in any diameter. All

*From the Wilmer Ophthalmological Institute of the Johns Hopkins Hospital and University.

TABLE 1
RESULTS OF FURMETHIDE THERAPY OF PRIMARY GLAUCOMA

Type of Glaucoma	Number of Cases	Tension Post Drug		
		25 mm. or less percent	26-35 mm. percent	36 mm. + percent
Congestive	41	46	29	25
Noncongestive	24	29	50	21
Total	65	40	37	23

other cases are classified as late. According to this classification 30 percent of the cases were early, 70 percent late. The tension was reduced to 35 mm. or less in 79 percent of the early cases and in 67 percent of the late cases.

Previous use of miotics. Forty percent of the patients had been on other miotics before furmethide was started. Usually these patients had been given a 2-percent solution of pilocarpine administered 3 to 4 times daily, with or without eserine ointment at night. Occasionally a 0.25-percent solution of eserine had been used 3 to 4 times a day, in one patient resulting in a severe eserine conjunctivitis. The tension was reduced to 35 mm. or less in 76 per-

cent of these patients as compared with a similar reduction of tension in 78 percent of the patients who had received no miotic therapy before furmethide was begun. In short, the drug was equally efficacious in patients in whom other miotics had failed.

TREATMENT OF SECONDARY GLAUCOMA

The use of furmethide was studied in a group of 41 patients with secondary glaucoma whose intraocular pressure before therapy was higher than 40 mm. Hg (Schiotz). The method of treatment was the same as in the treatment of patients with primary glaucoma. All of the patients were admitted to the wards of the hospital. The results of therapy are sum-

TABLE 2
RESULTS OF FURMETHIDE THERAPY OF SECONDARY GLAUCOMA

Type of Glaucoma	Number of Cases	Tension Post Drug		
		25 mm. or less percent	26-35 mm. percent	36 mm. + percent
Secondary to intracapsular cataract extraction	5	60	40	0
Secondary to extracapsular cataract extraction	6	17	33	50
Secondary to uveitis	15	27	13	60
Secondary to trauma	4	50	25	25
Secondary to aniridia	2	100	0	0
Secondary to venous thrombosis	9	0	0	100
Total	41	29	17	54
Total excluding venous thrombosis	32	37	22	41

marized in table 2. Furmethide had no effect on nine patients with glaucoma secondary to venous thrombosis. The tension was reduced to 35 mm. or less in 59 percent of the other cases of secondary glaucoma.

Untoward reactions. A possible systemic reaction to furmethide occurred in only one of the 106 patients treated with this drug. It consisted of moderately se-

SUMMARY

The results of furmethide therapy were studied in 106 patients with glaucoma whose intraocular tension before therapy exceeded 40 mm. Hg (Schiotz). Sixty-five of the patients had primary glaucoma, 41 had secondary glaucoma. All of the patients were admitted to the wards of the hospital. Furmethide reduced the tension to 35 mm. or less in 77 percent of

TABLE 3

COMPARISON OF THE FAVORABLE EFFECT OF TREATMENT WITH FURMETHIDE AND WITH MECHOLYL AND PROSTIGMINE ON VARIOUS STAGES OF PRIMARY GLAUCOMA: PERCENTAGE REDUCTION OF TENSION TO 35 MM. OR LESS

Treatment	Initial Tension over 55 mm. (S) percent	Initial Tension under 55 mm. (S) percent	Late Cases percent	Early Cases percent	Previous Use of Other Miotics percent	No Previous Use of Other Miotics percent	Total percent
Furmethide	75	80	67	79	76	78	77
Mecholyl and Prostigmine	54	75	41	92	44	77	58

* Statistically significant difference in percentage $d/\sqrt{d} > 2.0$.

vere perspiration, salivation, and lacrimation of brief duration, appearing 12 hours after the first administration of the drug. No local reactions occurred. None of the patients developed a local sensitivity to the drug.

FURTHER COMPARISON OF FURMETHIDE WITH MECHOLYL AND PROSTIGMINE

The data previously reported, on the 43 cases treated with mecholyl and prostigmine, may be compared with the data on the new total of 65 cases of primary glaucoma treated with furmethide. The results are summarized in table 3.

These figures substantiate the previously reported conclusion that furmethide is definitely preferable in late cases. In addition, furmethide was more effective than mecholyl and prostigmine in those cases in which the previous use of other miotics had failed.

the patients with primary glaucoma and in 59 percent of the patients with secondary glaucoma. A possible systemic reaction occurred in only one patient. No local reactions were noted, and none of the patients developed a local sensitivity to the drug. Additional experience with a large number of out-patients whose records are not sufficiently complete for statistical study is in accord with these results. The use of furmethide in the treatment of 65 patients with primary glaucoma compares favorably with the previously reported results on the use of mecholyl and prostigmine.

CONCLUSIONS

1. Furmethide is a valuable drug in the treatment of primary glaucoma, especially in the severer cases.
2. A 10-percent solution of furmethide

is more effective than the synergistic use of a 20-percent solution of mecholyl and a 5-percent solution of prostigmine in late cases of primary glaucoma, and in those cases of primary glaucoma in which the

previous use of other miotics has failed.

3. Systemic reactions to furmethide are rare. No evidence of local sensitivity or local irritation to the drug has been noted.

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ORAL PENICILLIN IN OCULAR INFLAMMATIONS*

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Many patients with acute inflammatory diseases of the eye and adnexa would be benefited by the administration of penicillin, yet the nature of the local disease is not of sufficient severity to warrant the hospitalization necessary for intramuscular injections. To circumvent this disadvantage local application has been utilized with some success, but it is recognized that application of an ointment may be difficult for the patient, and the blurring of vision subsequent to administration is annoying. The use of solutions is helpful, but the rapid deterioration of the medication when in contact with moisture lessens its successful and easy employment. Oral administration overcomes all these difficulties and allows the patient to carry on his customary duties without interference.

The excellent results obtained by Paul *et al.*¹ in oral administration of penicillin in combination with aluminum dihydroxy aminoacetate† (glycillin) prompted us to utilize this method for treatment of inflammations of the eye. The results in a

series of 15 cases which includes acute conjunctivitis, blepharoconjunctivitis, hordeolum externum and internum, and uveitis are outlined in table 1. The response in each case was similar to what could be expected from intramuscular injections.

It is recognized that the series here presented does not constitute a large number of cases, but the rapid and in many instances spectacular results prompted publication. Unfortunately, the cultures in all cases were not positive for pathogenic organisms, but each case treated was of sufficient severity that clinically a positive culture was expected.

In most instances where treatment was successful improvement had occurred within six hours after the administration of penicillin had been started, and in all cases there was definite subjective and objective healing after 24 hours. In the four cases of uveitis treated there was no evidence to show that the course of the inflammation was altered by the penicillin. In one case a skin rash developed which, according to the dermatologist, could have been due to the medication. The drug was stopped after 24 hours because of this, but improvement was noted in the blepharitis.

*From the Departments of Ophthalmology and Medicine, College of Medicine, State University of Iowa.

†Tablets supplied by Meta Cine Company, Chattanooga, Tennessee.

TABLE I

RESULTS FROM THE ORAL ADMINISTRATION OF PENICILLIN FOR
OCULAR INFLAMMATIONS

	Name	Age	Diagnosis	Duration	Daily Dosage	Days Treated	Culture	Outcome
1	B.R.	9	Multiple hordeoli & cellulitis lid	3 days	16,000 u., q. 1 h. 10 X	3	—	Much improved in 24 hours; healed in 3 days
2	B.C.	57	Acute catarrhal conjunctivitis	1 day	20,000 u., q. 1 h. 5 X	2	No growth	Healed in 2 days
3	A.F.	48	Acute catarrhal conjunctivitis	1 day	20,000 u., q. 1 h. 6 X	3	No growth	Healed in 3 days
4	F.L.	81	Acute catarrhal conj. (Postop.)	1 day	20,000 u., q. 1 h. 6 X	2	D. pneumoniae. nonhem. Staph.	Healed in 2 days
5	G.H.	43	Subacute catarrhal conjunctivitis	1 day	16,000 u., q. 1 h. 5 X	1	Nonhem. Staph albus	Improved in 1 day; healed in 3 days
6	M.W.	35	Acute blepharo-conjunctivitis	2 wks.	20,000 u., q. 1 h. 10 hrs.	1	Nonhem. Staph albus	Healed in 2 days
7	J.F.	75	Chronic blepharo-conjunctivitis	6 mo.	20,000 u., q. 1 h. 6 X	2	No growth	Markedly improved in 2 days
8	A.L.	62	Chronic blepharo-conjunctivitis	10 mo.	20,000 u., q. 1 h. 6 X	9	Hem. Staph. albus	Marked improvement in 6 days; slow improvement thereafter
9	E.S.	40	Chronic uveitis	1½ yrs.	16,000 u., q. 1 h. 10 X	5	—	No improvement
10	G.S.	47	Acute uveitis	2 days	20,000 u., q. 1 h. 5 X	5	—	No improvement due to penicillin
11	A.W.	59	Acute uveitis	2 days	20,000 u., q. 1 h. 8 X	5	—	No improvement due to penicillin
12	W.T.	67	Chronic blepharo-conjunctivitis	Several years	16,000 u., q. 1 h. 8 X	2	No growth	No improvement
13	F.Z.	24	Chalazion	2 days	20,000 u., q. 1 h. 5 X	3	No growth	No improvement
14	B.S.	34	Acute blepharitis	1 day	16,000 u., q. 1 h. 6 X	1	—	Slight improvement in 24 hours, but developed acute dermatitis
15	I.B.	47	Hordeolum internum	2 days	16,000 u., q. 1 h. 6 X	2	Hem. Staph. aureus	Marked improvement in 6 hours; healed in 2 days

Penicillin in combination with aluminum dihydroxy aminoacetate was the only medication used for these patients. Dosage of penicillin varied, but it appears that 20,000 units, given every hour for five doses, is optimum. In more severe infec-

tions 200,000 units may be given on the first day, and in all cases the treatment on successive days is determined by the clinical results obtained by the preceding day's dosage.

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SOME METHODS OF LID REPAIR AND RECONSTRUCTION

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The present war has given to some of us the unique if unhappy opportunity of seeing a large amount of traumatic pathology of the eye and its adnexa. Injuries to lids and sockets are so varied and the destruction at times so great that one's ingenuity is often taxed to the utmost to repair the ravages of exploding shells, burning tanks, and flaming oil.

Yet one fact about war injuries of the lids has particularly struck me: Despite the different types of lethal agents and the variety of wounds seen, if the destruction has not been total—that is, if one or both lids have not been wholly destroyed—these injuries fall into readily classifiable categories not unlike those seen in civilian life.

This is no place for involved statistics. Let it suffice to state here that of the first 100 patients requiring plastic surgery seen on the Eye Service of this Hospital, 41 had injuries of the upper lid, 23 had injuries of the lower lid, and 36 had both lids injured. Of all these, 78 had or required enucleations. The lid notch or V-shaped incisura occurred almost twice as often as any other single lesion. Furthermore, it was found nine times more often in the upper lid than in the lower. Avulsion of the lower lid from the internal canthus with or without loss of lid substance was next in incidence. Cicatricial ectropion, paralytic ptosis, and cicatricial lagophthalmos were next in occurrence and about equal in incidence. Less common were the lunate (crescent shaped) deformities of the lid margin as well as ankyloblepharon and blepharophimosis. Not infrequently two or three of these lesions occurred simultaneously. Symblepharon was a concomitant of about half the cases. Sometimes this was of such

proportions as to require epithelial or mucous-membrane grafting to obtain an adequate socket for the reception of a prosthesis.

It should be stated that the incidence of cases given here has no relation whatever to the general incidence of ocular injuries in the present war. Of the latter I am not competent to speak. It should also be added that the injuries discussed in this series of contributions are only the more severe ones in patients who were sent back to this country for definitive treatment. Some of these men had to be treated for other injuries, more urgent, before plastic repair of the lids could be started. Hence, due to the exigencies of war, this could not be begun sometimes until 4 to 10 months after the injury had been incurred.

With so much material to see and work to do one cannot help but adopt certain favorites among the old techniques of lid repair and even try some new modifications. It is the purpose of this and subsequent communications to present some of the results of this work.

THE LID NOTCH

Many operations have been devised for the repair of the V-shaped lid notch. These need not be detailed to ophthalmologists. The best of them is Wheeler's¹ "halving" procedure or some modification of it. This still remains the classic procedure for most lid notches. With this method, however, some healthy skin must be sacrificed to obtain separate skin and tarsal suture lines which do not overlie each other. Furthermore, even with the most painstaking technique (at least in my hands) a small marginal hiatus is occasionally left which requires further

surgery. Also; in some of the cases seen here so much tissue had been lost that I was loathe to sacrifice any more. With a view toward circumventing these objections the following technique was devised:

The edges of the notch are freshened, and all scar tissue resected, care being taken to remove a minimum of healthy tissue. The lid in the region of the notch

sliding flap is freely mobilized by adequate dissection behind the conjunctiva, so that when it is drawn into place there will be no pull on the lid. A double-armed 3-0 black silk suture is passed through the edge of this flap from without inward (toward the conjunctiva) then through the horizontal edge of the rectangular dehiscence. The needles are passed through to the skin surface above or below the

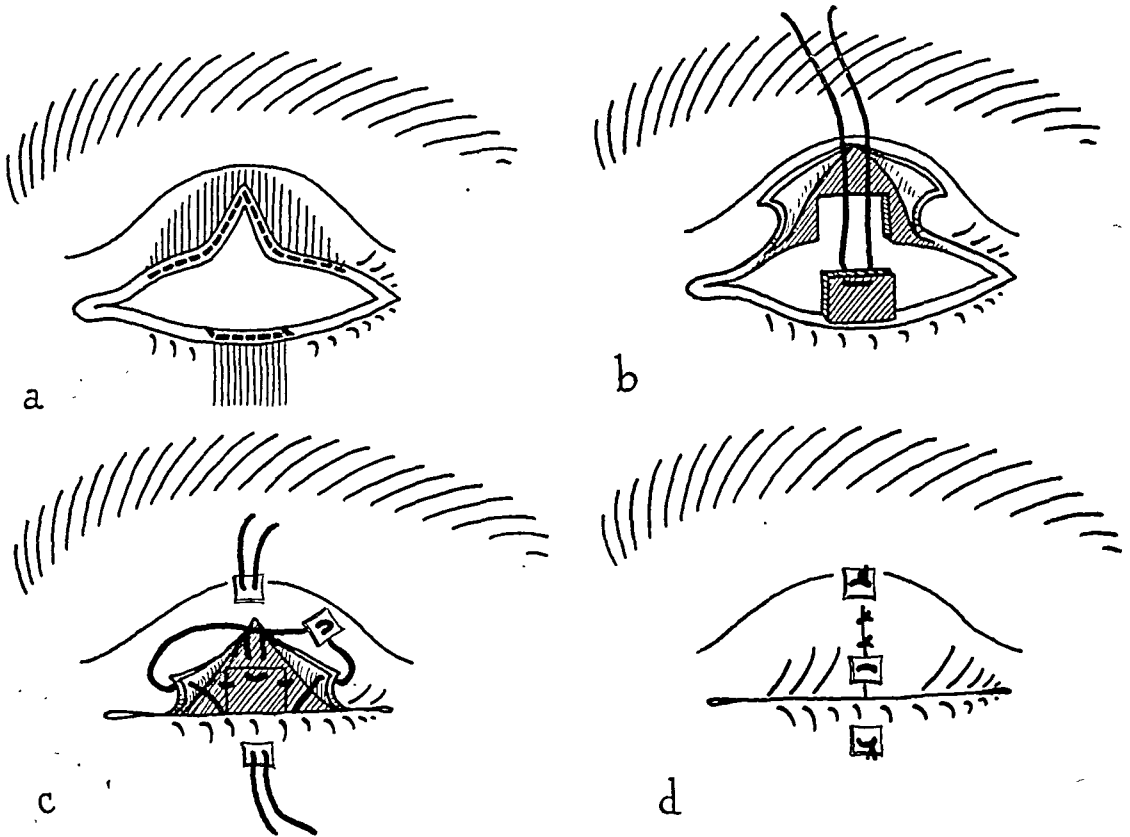


Fig. 1 a, b, c, d (Fox). Technique used for repair of lid notch in cases 1 and 2.

is split into skin-muscle and tarso-conjunctival layers, and the skin-muscle layer freely mobilized by dissection. The fellow lid is split opposite the notch but only for a distance equal to the notch at the border (fig. 1 a). The notch in the tarso-conjunctiva is then converted into a rectangle by resection of the apex (fig. 1 b). From the opposite split lid a tongue of tarso-conjunctiva is fashioned which will fit snugly into the rectangle (fig. 1 b). This

notch (depending on its position in the upper or lower lid) and tied over a peg. If the notch is large, a suture of 4-0 plain catgut may be used on each side to help hold the flap in place (fig. 1 c). A double-armed 4-0 black silk suture is then threaded through another peg and the needles passed through the marginal edges of the skin-muscle notch from without inward. They are carried in front of the flap and then through the skin-

muscle layer of the uninjured lid, where they are brought out beyond the lash line and tied over a peg (fig. 1 c). Two or three additional interrupted black silk sutures are used to complete closure of the skin-muscle wound (fig. 1 d). A firm (not pressure) dressing is applied with bandage. This is changed on the fourth day for a patch. The sutures are removed on the sixth day. The eye is then dressed daily and can usually be left unpatched on the ninth or tenth day. The lids are separated after three weeks.

In case of an empty socket, a con-former should be inserted to assure

active treatment of his wounds and was admitted to this hospital on November 30, 1944. On January 11, 1945, repair of the right upper lid (fig. 2 a) was made, by means of the technique shown in figure 1. The result with permanent prosthesis is shown in figure 2 b.

Case 2. The soldier was injured on September 26, 1944, at Castro del Rio, Italy, when an enemy shell exploded near him and fragments entered his right eye. The eye was enucleated on September 28, 1944, at the 37th General Hospital, and on October 7, 1944, primary repair of his right upper lid was made. The patient



Fig. 2 a, b (Fox). Case 1, before and after repair of notch of right upper lid.

proper position of the pedicle flap. At first the arms of the marginal double-armed suture were crossed before insertion into the opposite lid was made, but this was found to be an unnecessary refinement and was subsequently discarded. When the notch is near either canthus, the incision splitting the lid is prolonged beyond the canthus to give sufficient mobility to the skin-muscle layer. No canthotomy is done.

CASE REPORTS

Two of 16 cases are reported.

Case 1. The soldier was injured on September 29, 1944, near Mancio, France, in a land-mine explosion. He sustained wounds of his right eye, right arm, and both legs. His right eye was enucleated the same day at the 11th Evacuation Hospital. He was shipped home for defini-

was returned to the United States and admitted to this hospital on December 2, 1944. On admission he had moderate notching and scarring of the right upper lid (fig. 3 a). On eversion of the lid, however, it was observed that the temporal half of the tarsus was involved in a mass of scar tissue all of which would have to be resected before a prosthesis could be inserted (fig. 3 b). On January 17, 1945, plastic repair of the lid was performed according to the technique outlined in figure 1. Figure 3 c shows the results three weeks after the repair and before the lids were separated. Figure 3 d shows the socket after repair. The final result with temporary prosthesis in place is shown in figure 3 e.

COMMENT

Case 1 (fig. 2 a, b) illustrates the type

of lid notch most commonly encountered: A somewhat large lesion more or less centrally placed. Case 2 (fig. 3) is deceptive. Tissue loss (fig. 3 a) was apparently minimal. As has been pointed out, however, a large portion of the upper tarso-conjunctiva had to be resected (fig. 3 b) before an adequate prosthesis could

of tissue has been minimal. In favor of it are the following facts: (1) No skin is resected. (2) The lid is not shortened. (3) The halving principle is retained. (4) Unless the notch is near a canthus no additional skin incisions are needed, and external scarring is consequently minimal. (5) Secondary surgical pro-

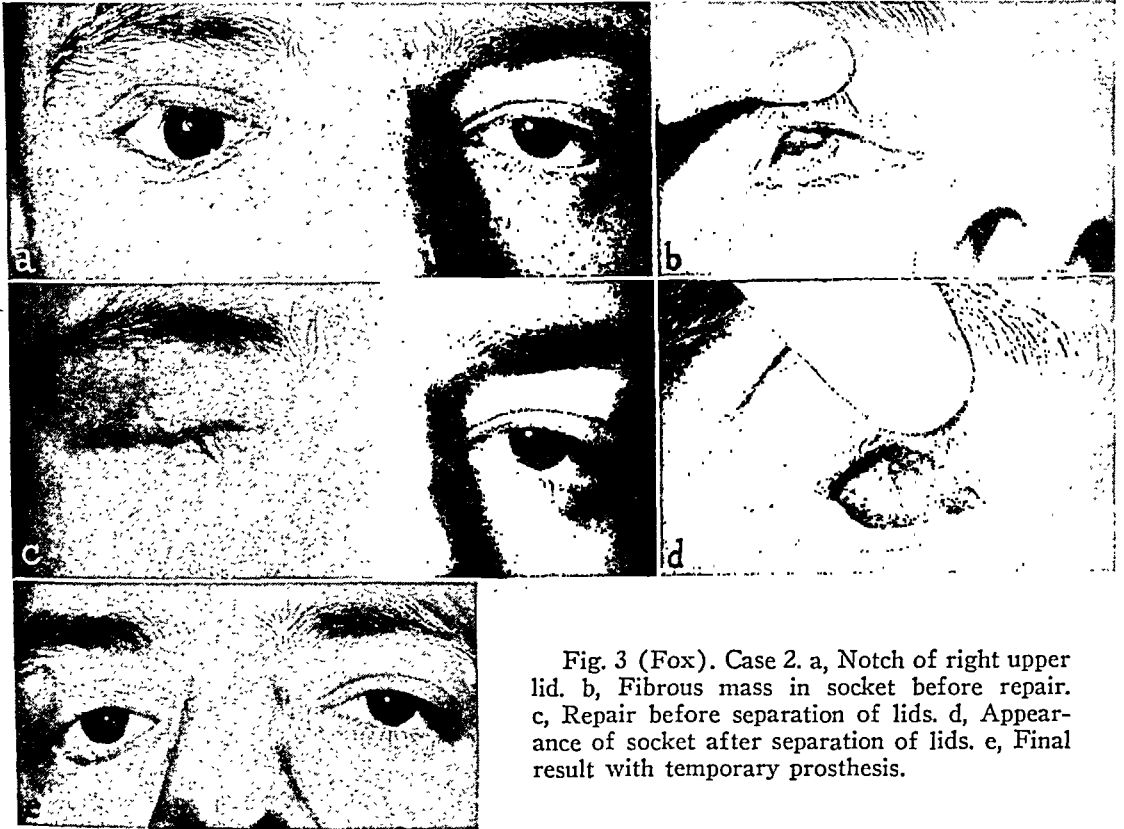


Fig. 3 (Fox). Case 2. a, Notch of right upper lid. b, Fibrous mass in socket before repair. c, Repair before separation of lids. d, Appearance of socket after separation of lids. e, Final result with temporary prosthesis.

be fitted (fig. 3 e). Had the usual halving repair been used, appreciable shortening of the lid would have resulted. The technique outlined in figure 1 would seem to be especially desirable in this type of case.

This procedure has now been used sufficiently often to permit of reasonably adequate evaluation. It is not suggested that it should supplant other procedures or that it is even applicable in all cases. Against it is the fact that it disturbs the anatomic relations of the normal opposing lid. It is also unnecessary where the loss

cedures are not needed unless lash grafting is done later.

LUNATE (CRESCENT-SHAPED) DEFORMITY OF THE LID MARGIN

Where lid injuries are seen in large numbers bizarre deformities are encountered. One of these, occurring not too commonly, is the lunate or crescent-shaped dehiscence of the lid margin. The loss of tissue is not extensive. The dehiscence is usually shallow, amounting to 6 or 8 mm. at its widest point. But most of the margin is involved and with it, of

course, the lash line. A good example of this type of lesion is seen in figure 5 a, b. Figure 6 a is even more characteristic but, unfortunately, the photograph is not too clear.

This injury, although not striking, requires as much planning and as painstaking a technique as do some of the more serious deformities. The following method has given satisfactory results:

two mobile flaps, one of tarso-conjunctiva and the other of skin-muscle, are created. These two flaps are pulled beyond the lid edge so that the point of deepest indentation of the deformity is on a level with the normal lid margin. The excess is resected (fig. 4 b). Three double-armed 4-0 black silk sutures are threaded through pegs and passed through both flaps near the lid margin from without

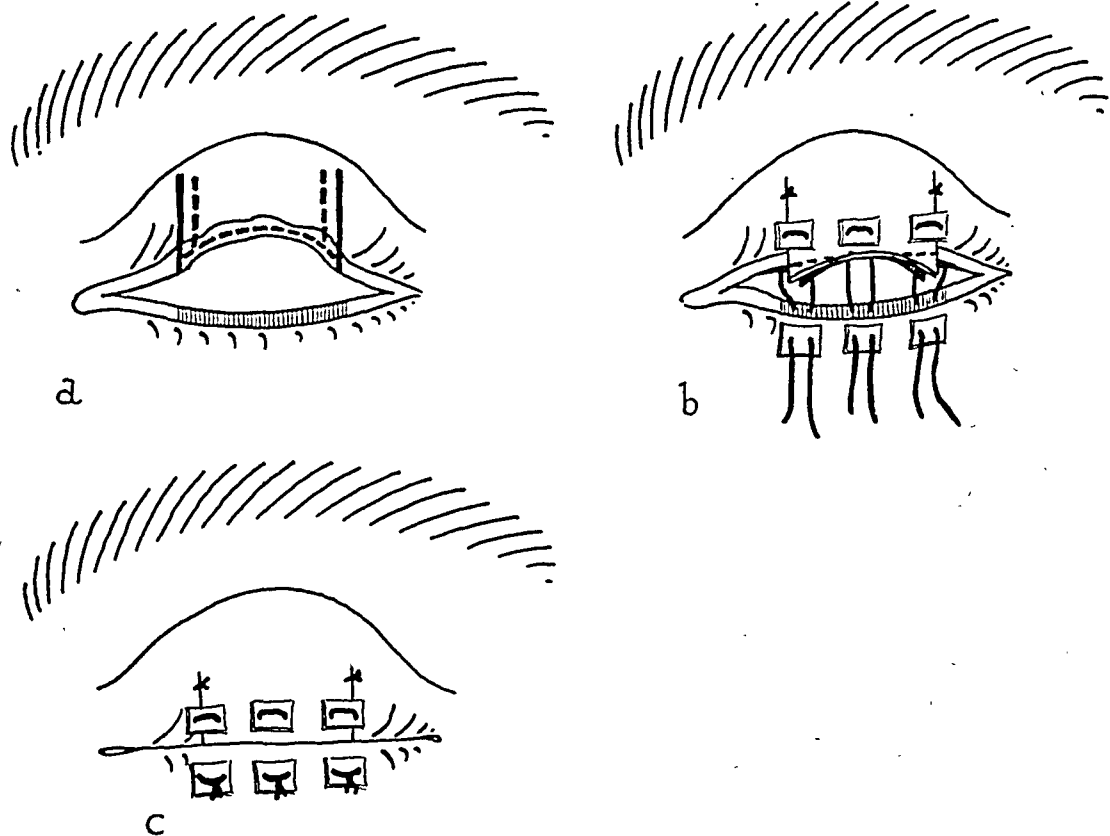


Fig. 4 a, b, c (Fox). Technique used for repair of crescentic lid-notch deformity in cases 3 and 4.

The affected portion of the lid margin is split into two layers, and the dissection carried sufficiently beyond the tarsus to obtain adequate mobilization. At the ends of the split, two vertical incisions are made in the tarso-conjunctival layer for a distance of 10 mm. Similar incisions are made in the skin-muscle layer but these are placed 2 mm. to the outside of the tarso-conjunctival incisions in order to obtain a halving effect (fig. 4 a). Thus

inward. One is centrally placed; the two lateral ones are inserted so as to straddle the verticle incisions (fig. 4 b). The edge of the opposing lid is freshened and the sutures are carried through this edge to come out beyond the lash line, where they are tied over pegs. One or two additional sutures are used to close the skin-muscle incisions. A conformer is inserted into the socket where no eye exists. A monocular dressing with bandage is ap-

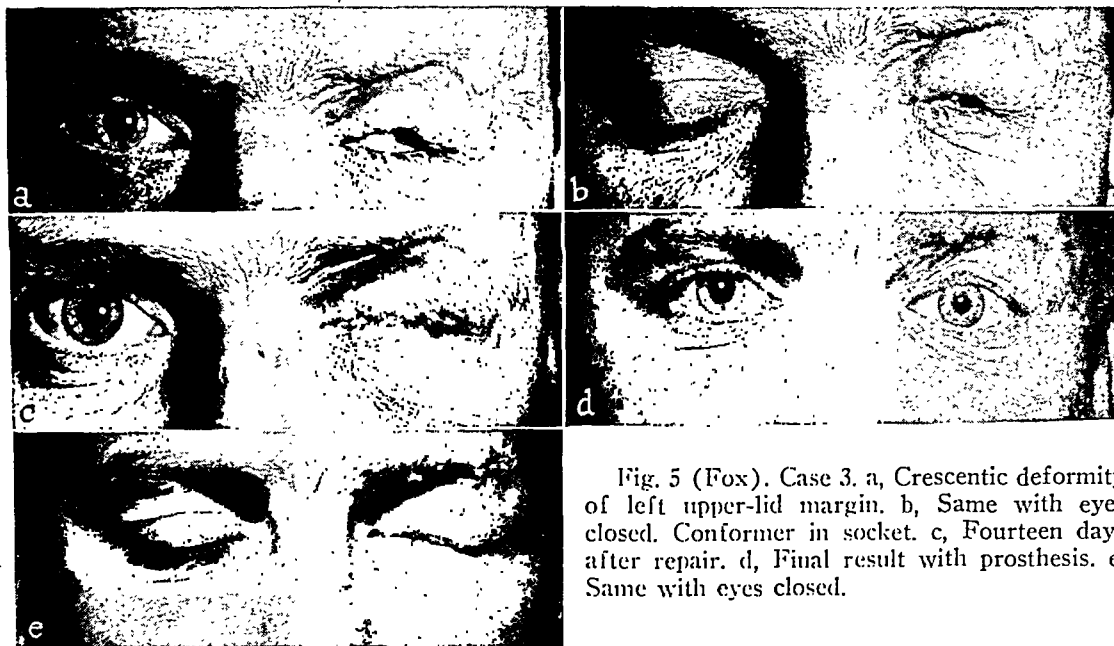


Fig. 5 (Fox). Case 3. a, Crescentic deformity of left upper-lid margin. b, Same with eyes closed. Conformer in socket. c, Fourteen days after repair. d, Final result with prosthesis. e, Same with eyes closed.

plied. The eye is redressed on the fifth, eighth, and tenth days, at which time the sutures are removed. The tarsorrhaphy may be opened in four to six weeks; or lash grafting may be done at this time.

CASE REPORTS

Case 3. The soldier was injured on August 6, 1944, on the Island of Guam by an enemy sniper bullet. He sustained wounds of the right hand, left eye, and left upper lid. The left eye was enucleated on August 9, 1944. The patient was returned to the United States and admitted to this hospital on November 1, 1944. On December 12, 1944, the left upper lid was repaired by means of the technique shown in figure 4. The result with eyes open and closed is shown in figure 5 d and e.

Case 4. The soldier was injured on July 7, 1944, near St. Lo, France, by enemy shell fragments. He sustained wounds of the back, right arm, right hand, left eye, and left lower lid. The left eye was enucleated on July 8, 1944. The patient was returned to the United States and admitted to this hospital on November 6, 1944. On November 24, 1944, plastic repair of the left lower lid was performed

according to the technique shown in figure 4. Figure 6 shows the lesion before and after repair.

COMMENT

This may seem like formidable surgery for a lid deformity which is not too strik-



Fig. 6 a (Fox). Case 4. Crescentic deformity of left lower-lid margin before surgery.



Fig. 6 b (Fox). Case 4. Same patient as in fig. 6 a after surgery.

ing. But attempts at simplifying the procedure have resulted in failure. Trials at pulling down a solid flap (without splitting) have not been successful. Also, omission of a surgical tarsorrhaphy have resulted in only partial correction with this technique. As can be seen from figures 5 and 6 a fair cosmetic and functional result is obtained with this type of repair. Lash grafting, performed in case 3 while the lids were united (fig. 5 c), was not successful. It was not done in case 4.

Other methods can be used for the repair of this type of deformity. As a matter of fact, another technique was evolved subsequently which will be reported in a later communication. How-

ever, the method herein outlined is adequate.

One final word: Time is the best ally of the plastic surgeon. With the passage of time scars diminish and discolorations fade. I have rarely seen a case following plastic repair which did not improve cosmetically as time went on. In the cases reported here the results are early ones. Once surgery is completed and the wound adequately healed, patients have to be sent away. Follow-up six months or a year later is not possible; the soldiers are either discharged or returned to duty. All the results reported in this series of communications should be judged with this in mind.

Newton D. Baker General Hospital.

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REPORT OF A CASE OF IRIDOCYCLITIS ASSOCIATED WITH CHICKENPOX*

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A case of unilateral iridocyclitis which occurred during the course of an attack of varicella recently came under observation. The rarity of this combination is attested to by the paucity of published reports. Duke-Elder¹ refers to a case reported by Hutchinson in 1887 of a 21-month-old child with chickenpox who developed, on about the ninth day of the disease, a bilateral uveitis which resulted eventually in phthisis bulbi. No lesions of varicella were noted on the lids, conjunctiva, or cornea. To my knowledge no other cases of uveitis in association with varicella have been reported in the modern literature.

REPORT OF CASE

A 7-year-old white boy developed chickenpox on April 26, 1945. His temperature was moderately elevated for the first three days of his illness. The exanthem appeared diffusely over his body and face, and lesions were also noted on the mucous membrane of the oral cavity. On April 28th the patient's mother noticed that there was a slight discharge from his right eye and that the eye was red. He complained only of a frontal headache. The secretion from the eye disappeared within a day or two, without any local treatment, but the eye remained red. On May 2d he was referred by the pediatrician, Major A. O. Manske, for ophthalmologic consultation.

Examination revealed vision of 20/20 in each eye. The left eye was and remained completely normal. The palpebral conjunctiva of the right eye was mildly

injected, the bulbar conjunctiva more intensely so, and a moderate ciliary flush was noted. There was no secretion from the eye. The pupils were round and equal and reacted normally to stimulation. The tension to finger palpation was normal. A healing, crusted lesion on the right side of the bridge of the nose was the closest external manifestation of varicella to the eye. Upon biomicroscopic examination a moderate number of fine precipitates and a few small keratitic precipitates were discovered on the posterior corneal surface. A moderate number of cells freely floating in the thermal convection current of the aqueous and a well-marked aqueous flare were also noted. The iris and lens appeared normal; no synechiae were seen. The vitreous was clear and the fundus was normal.

A diagnosis of acute, iridocyclitis of the right eye was made. The application of hot wet packs to, and the instillation of 1-percent atropine sulfate solution in, the right eye three times daily were prescribed. An etiologic survey was then instituted.

Past medical history elicited the fact that the child had been an essentially normal, healthy infant. He had had an attack of cervical adenitis at two-and-one-half years of age and of mumps at five years. Urticaria, probably from grape juice, occurred once when he was six years of age. No recent immunization had been performed. The only previous ocular disease was an attack of "pink eye" two years prior to the presently reported episode.

Other than the subsiding exanthem and the ocular signs, physical examination revealed only a moderate cervical lymphad-

* From the Ophthalmologic Service of Lt. Col. Phillips Thygeson (MC), A.U.S.

enopathy. The tonsils were cryptic and of average size. The paranasal sinuses transilluminated clearly. The dentist exonerated the patient's teeth as possible foci of infection. The chest X ray was normal.

Urinalysis was normal. The blood Kahn, the tuberculin test, and the blood agglutination test for undulant fever were all negative. On May 4th erythrocytes numbered 3,820,000 and the leucocytes 5,200; the hemoglobin was 11.6 grams and the blood smear revealed 37 percent neutrophils, 56 percent lymphocytes, 1 percent monocytes, 5 percent eosinophiles, and 1 percent basophiles. On the same date the blood sedimentation rate was 40 mm. in the first hour.

Rapid clearing of all eye signs occurred, so that by May 7th the conjunctiva no longer appeared congested; the cornea and anterior chamber were completely cleared; the iris was normal; the pupil fully dilated, and the lens clear. Atropine was reduced to one instillation daily. Only a few small fading lesions of varicella remained on the body.

When next seen, on May 10th, a moderate bulbar conjunctival injection and ciliary flush were again noted. The pupil was about three fourths dilated. Numerous discrete, lardaceous keratitic precipitates were seen on the posterior corneal surface. A moderate number of floating cells in the anterior chamber and a faint aqueous flare reappeared. The tension to fingers was normal. Atropine instillations

were increased to three times daily and, upon the advice of the pediatrician, bed rest was ordered for the next few days. Medication for the moderate anemia was started. The sedimentation rate repeated on that day was 6 mm. in the first hour.

The patient was again seen on May 14th. The eye was then white, the pupil fully dilated, the keratitic precipitates completely gone, and the flare in the anterior chamber markedly diminished. On May 16th, except for the dilated pupil, the eye was clinically normal and has remained so to date.

Comment. In the absence of any other demonstrable cause it is probably reasonable to assume that this patient's iridocyclitis resulted from his coexisting chickenpox. Since, furthermore, the lids, conjunctiva, and cornea were free of vesicles or pustules, there must also be assumed a direct action upon the uvea by the virus, or its toxins, circulating in the blood stream. An unusual feature in the course of this case was the rapid appearance, after a period of improvement, of large lardaceous keratitic precipitates and their equally sudden disappearance. This type of precipitate is usually associated with long-standing severe cases of a granulomatous nature and typically does not exist so transiently as in this case. In all other respects no difference from a mild iridocyclitis was noted.

AAF Regional Station Hospital.

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NOTES, CASES, INSTRUMENTS

DENTAL ACRYLIC IMPLANT FOR USE IN EVISCERATION OR ENUCLEATION OF THE EYEBALL

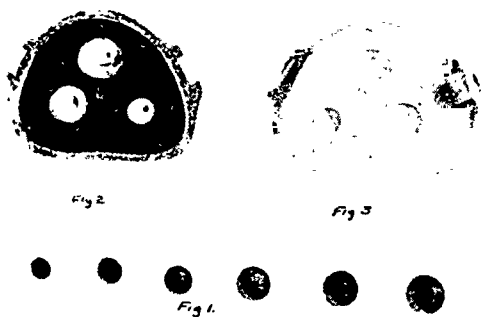
SQUADRON LEADER M. W. NUGENT*
Winnipeg, Manitoba, Canada

Dental acrylic is an easily obtainable and inexpensive eye implant that can be used after eviscerations or enucleations of the eyeball where an implant is desirable.

In recent years it has become increasingly difficult to obtain satisfactory implants, with the result that many eye sockets are not receiving the cosmetic benefit which an implant affords.

METHOD

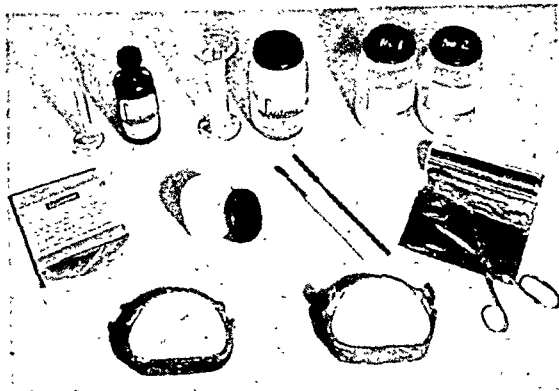
In making spherical eye implants from dental acrylic (methylmethacrylate res-



Figs. 1-3 (Nugent). Sizes of implants and embedding in denture flask.

in), the implants are first formed from dental base plate wax in the desired range of sizes as shown in figure 1. An adequate size range includes those varying in diameter from 8 to 20 mm., in 2-mm. differences; namely 8, 10, 12, 14, 16, 18, and 20. These are then invested in the bottom half of a denture flask (fig.

2), by the use of dental stone, only two fifths of each implant being embedded. When the dental stone has set, the exposed wax surfaces are covered with tinfoil one one thousandth of an inch in thickness. All wrinkles must be carefully ironed out. This foil is shown in figure 11, and is



Figs. 4-12 (Nugent). Equipment for making implant.

identical with that used in processing acrylic dentures. The exposed stone surface is now painted with a separating medium, and the top half of the denture flask filled with dental stone. Formation of air bubbles is avoided by carefully vibrating the flask. When this has set, the denture flask is placed in boiling water for 10 minutes. The flask is then opened, and the wax boiled out, after which the flask is allowed to cool and the acrylic is packed.

To prepare the acrylic, 9 c.c. of monomer (liquid), as shown in figure 6, is poured into a mixing jar such as that seen in figure 7. A powder measure is used to add four portions of polymer (powder, fig. 5) to the monomer. If a powder measure is not available add polymer (powder) slightly in excess of the amount required to absorb the 9 c.c. of monomer (liquid). The mixing jar is covered and allowed to stand for five minutes, after which the contents are thoroughly mixed

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with a stainless steel spatula (fig. 12) until the color is incorporated. The cover is again placed on the mixing jar, and it is allowed to stand until the mixture can be removed as a "putty-like" mass. This will require about 20 minutes, depending on the temperature of the room and the mixture. This mixture (dental acrylic) is sufficient to make a set of seven eye implants ranging in diameter from 8 to 20 mm., in 2-mm. differences.

The acrylic is now packed firmly into the top half of the denture flask, which represents three fifths of each implant. The acrylic is piled up sufficiently so that it will fill the bottom half of the denture flask, which represents two fifths of each implant. A sheet of wet cellophane (fig. 10) is placed over the acrylic and the two halves of the denture flask are brought together. Slow and even pressure is then applied to the packed denture flask by means of a pressure clamp or dental press. This allows any excess acrylic to escape. When the flask is completely closed it is removed from the press and opened. The cellophane is stripped off and the surplus acrylic cut away. Fresh acrylic is now added to each implant, the wet cellophane again placed in position, and the pressing procedure repeated. This is necessary in order to expel any air bubbles that may have been trapped in the acrylic and not entirely expelled by the first press. The flask is again removed from the press and opened, the cellophane stripped off, and the surplus acrylic cut away. The next step is to line the implant impressions in the bottom half of the flask with tinfoil, close it, and return it to the press. It is now ready for curing.

The method herein outlined can be used in making implants from clear or pink acrylic. A simpler method exists if implants of pink acrylic only are desired. In this instance solutions of waterglass may

be used in place of the tinfoil and cellophane. When the wax is boiled out and while the case is still hot, both halves of the implant impressions are coated liberally with waterglass solution number one (fig. 4), which consists of one part waterglass to six parts of water. This is allowed to stand for two to three minutes, then the excess is wiped away and waterglass solution number two (fig. 4), which is made up of two parts of waterglass to one part of water is applied. When the flask is cold and ready to pack with pink acrylic, the waterglass will be dry and glazed.

It is a matter of individual choice whether clear or pink acrylic implants are used, as one has no advantage over the other. However, because of the simpler and quicker method that can be employed in making implants of pink acrylic, this has become the writer's choice.

The final two steps are those of curing and finishing. The curing of the acrylic must be done by the slow method. To do this the flask is completely covered in water of room temperature, placed over a slow heat, and one hour allowed to bring it to 162°F. It is then held at that temperature for four hours, following which the flask is removed from the bath and bench cooled for approximately one hour. The implants are then dug out and finished off. The finishing is done by first removing the ring of surplus acrylic with a fine emery band on an arbor chuck and then polishing with a soft cotton buff and fine pumice, followed by a clean buff and whiting.

DISCUSSION

Almost all eviscerations or enucleations of the eyeball should be followed by some form of implant within the sclera or Tenon's capsule, as the case may be. The only real contraindication to such a procedure is the presence of infection, mak-

ing adequate open drainage a surgical necessity.

Because of the difficulty in obtaining satisfactory implants many eyes are being removed and no implant used. This is a decided disadvantage to a good cosmetic result, for it permits more sinking-in of the periorbital and peribulbar tissues. Another factor in favor of the use of an implant is that it gives a better bed on which the artificial eye can rotate and to a greater extent helps lessen the starness of an artificial eye that rotates too little or not at all.

Bone, cartilage, or fat implants can be discarded as inadequate. Gold, platinum, tantalum, or vitalium implants, although excellent, are both expensive and, for the past few years, almost impossible to obtain. Mules's spheres are hollow, occasionally break *in situ*, and are also difficult to obtain. The solid glass ball is not to be recommended because of its weight, which increases the possibility of postoperative extrusion. Implants made of dental acrylic (methylmethacrylate resin) have no apparent disadvantages in that they are inexpensive, easily obtainable, light in weight, and well tolerated by the soft tissues of the orbit. To date the writer has had no extrusions or allergies with this type of implant.

In conjunction with the use of dental acrylic implants, accepted surgical methods were used. In enucleations, Tenon's capsule and the extraocular muscles were overlapped in front of the implant, 00-chromic catgut being used, and the conjunctival layer closed separately with 00-plain catgut. In eviscerations, the scleral tissue was overlapped in front of the implant, again with the use of 00-chromic catgut, and Tenon's capsule and conjunctiva were closed separately with 00-plain catgut. Following these clo-

sures 5-percent sodium sulfathiazole ointment was applied, and a pressure bandage placed in all cases. The pressure bandage was not disturbed for seven days, but reinforced when indicated.

All implants of dental acrylic used were spherical in shape. Bizarre shapes were not considered, since it has been shown that the spherical shape is adequate.

The size of the dental acrylic sphere to be used in each case is important. The largest spherical implant that Tenon's capsule, or the sclera, will hold without tension and allowing for adequate overlapping of tissues should be used in all cases. For this purpose sizes ranging in diameter from 8 to 20 mm., in 2-mm. differences, should be kept at hand.

SUMMARY AND CONCLUSIONS

1. The method of making eye implants from dental acrylic has been outlined. This is only a variation in the everyday work of a dental technician and is not necessarily original.

2. They can be obtained easily and inexpensively from any dental laboratory.

3. They replace adequately all other types of implants.

4. To date, no contraindications of their use have arisen.

5. The size of dental acrylic implant to be used is important, and the use of a pressure bandage is to be stressed.

Acknowledgment. The author wishes to thank Warrant Officer W. J. Mitchell of the Canadian Dental Corps, for carrying out the details of technique in the making of these implants, and for keeping our supply adequate during the past two years.

1930 Wilshire Boulevard
Los Angeles 5

CONGENITAL MEMBRANOUS CATARACT

EUGENE M. BLAKE, M.D.

New Haven, Connecticut

At the March 27, 1944 meeting of the Los Angeles Society of Ophthalmology and Otolaryngology (reported in the *American Journal of Ophthalmology*, 1945, volume 28, number 8), Dr. Etta C. Jeancon related the case of a two-year-old child with congenital cataracts which she thought to be unique. The child was apparently normal in all respects except for the lenticular opacities.

When a discission operation was performed it was found that only an empty capsule existed, and no cortical matter was present. Following the operation, there was practically no postoperative reaction, the pupil was clear, and the fundus seemed to be normal. The parents were of the opinion that the cataract was not so densely white at the age of one year as it had been at birth, and Dr. Jeancon assumed that this was a congenital morgagnian cataract in which complete absorption had occurred. She quoted Dr. Ida Mann to the effect that this type of cataract is caused by lack of development of central fibers, or an early secondary degeneration of these fibers which have disintegrated and softened, the nucleus sinking to the bottom of the capsule. No record could be found of such complete absorption of the degenerated cortex.

This account prompts the reporting of a strikingly similar case seen by the writer in which he performed the operation. On January 28, 1944, the mother, who was a young army nurse, brought her two-months-old baby for advice, having been told at an army base hospital that her son had congenital cataracts. The infant was tiny but well nourished. The eyeballs were noticeably small, the corneas meas-

uring 8 mm. There were an alternating esotropia and a roving nystagmus as well as lenticular opacification. Upon inquiry the mother stated that she had had German measles during the second month of this, her first, pregnancy. When the pupils were dilated by hyoscine the lenses showed a white, asbestoslike opacity, with no clear cortex. Bilateral discission was proposed, and on July 10, 1944, the operations were performed.

When the knife-needle was drawn across the capsule it divided readily, leaving a clear black pupil at once. The same condition was noted in both eyes. No soft lens matter was present, and there was practically no reaction following the discissions. No satisfactory view of the fundi was obtained because of the nystagmus and the small pupils.

In addition to the ocular changes mentioned, the baby had a patent ductus arteriosus.

When seen last, in September, 1945, the pupils were clear and a good fundus reflex was present. There was marked esotropia, apparently alternating, and the child, now 21 months of age, walked about, avoiding obstacles, reaching for lights, and showing other signs of visual capacity. Lenses of +8.00D. were prescribed.

The writer has been unable to find a description of a similar congenital membranous cataract, except the one reported by Dr. Jeancon. Dr. Ida Mann places the time at which congenital morgagnian cataracts are formed as in the sixth month of gestation. Since the mother of the baby here described developed German measles during the second month of her pregnancy it would not seem likely that the membranes present resulted from absorption of cortex, but rather from a failure of cortical fibers to develop.

303 Whitney Avenue.

SOCIETY PROCEEDINGS

EDITED BY DONALD J. LYLE

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

February 5, 1945

DR. MILTON L. BERLINER, *presiding*

BOECK'S SARCOID

DR. ERNST WALDSTEIN presented an 18-year-old Negro girl who complained of pain in her chest in October, 1944. Her history up to that time was negative except for dysmenorrhea and a mild parametritis. An X-ray picture at that time revealed an adenopathy in the mediastinum and a tentative diagnosis of Boeck's sarcoid was made. She had no cough, no fever, and was anergic to tuberculin. In December a biopsy specimen of a slightly enlarged axillary node was secured, and the diagnosis of Boeck's sarcoid was established. No osteoporosis cystica of the fingers or toes had been found.

The patient was seen for the first time early in 1945. She had a painful and irritated right eye, with numerous keratic precipitates and vitreous opacities. The cornea and retina were normal. For approximately two weeks a grayish, somewhat vascularized nodule with a smooth surface had been visible in the angle of the anterior chamber at the 6-o'clock position. It appeared to be growing rapidly. There was also a pea-sized subcutaneous round tumor in the upper temporal angle of the right orbit. The patient received X-ray treatment of the chest. Eye therapy was purely symptomatic.

Boeck's sarcoid, a misleading name, is a chronic granulomatosis of moderate malignancy, attacking especially the reticulo-endothelial system and in particular the lymph nodes. Involvement of the eye

seems to occur in about 5 percent of the reported cases. The retina is very rarely, and the cornea never, affected. The diagnosis is established by biopsy specimen from a lymph node. Caseation in the pseudotubercle is never present; no organisms have ever been found. The disease has its exacerbations and remissions, the eye lesion either becoming absorbed spontaneously or proceeding to phthisis bulbi or secondary glaucoma with loss of the eyeball.

It appears that Boeck's saracoid is not so rarely found in the eye as is frequently thought.

PENICILLIN IN THE TREATMENT OF PERFORATING INJURIES OF THE EYE

DR. DANIEL M. ROLETT described the results of the use of penicillin in four cases of perforating ocular injuries.

Case 1. Mrs. D. H., aged 66 years, suffered a spontaneous rupture of a glaucomatous eyeball. Enucleation with gold-ball implant was performed. Secondary infection of the eyeball developed with expulsion of the implant. There were general malaise and fever. One hundred thousand units of penicillin administered intravenously checked the infection quickly and effectively.

Case 2. Mr. A. S., aged 41 years, had a traumatic rupture of the cornea with loss of vitreous and injury to the iris, ciliary body, and lens. Surgical repair of the damaged tissues was performed, but five days later infection set in and advanced rapidly despite vigorous routine treatment in the hospital. Penicillin was administered, and 48 hours subsequently the infection was checked.

Case 3. Mr. L. E., aged 49 years, suf-

ferred a perforating corneal wound with secondary infection manifest on the first day after the injury and accentuated on the following day. Penicillin checked the infection.

Case 4. G. H., aged nine years, sustained a perforating injury of the cornea with subsequent evidence of infection. Penicillin therapy was instituted. Recovery was rapid, with restoration of vision to 20/40.

In all these cases smears and cultures taken from the eyes preoperatively and postoperatively revealed heavy growth of staphylococci and some were contaminated by occasional pneumococci.

It was concluded that enucleation of even severely injured eyes should be delayed until penicillin therapy is given a fair trial.

MELANOMA OF THE SKIN WITH OCULAR AND ORBITAL METASTASES

DR. J. R. LISA described a man, aged 68 years, who had a painful skin tumor removed from the chest wall. Eighteen months later there were local recurrence and axillary lymphatic metastases, which were excised. Soon after, there developed multiple subcutaneous lesions, weakness, weight loss, and increasing loss of vision. The patient died within six months, and at autopsy there were found extensive metastases, including those to the eye and orbit.

Discussion. Dr. Isadore Givner reviewed the literature to date and could find only 15 cases verified histologically both as to primary and metastatic foci. Of these, only two, those of Terplan, and of Meigs and de Schweinitz, had the orbit as a metastatic area. In 73 autopsies of patients dying of melanoma, Kreibitz reported 26 as originating from sarcoma of the choroid. Metastatic lesions in the eye are characteristically multiple, flat, and bilateral. Evidence of their being

metastatic is further added to by (1) limitation to certain areas; (2) being surrounded by comparatively healthy tissue; and (3) the presence of blood vessels within them containing cells of the same character.

Of the 15 cases of metastatic sarcoma of the eye, 5 cases were bilateral. The site of origin was 6 times from the skin, 3 times from the mediastinum, and once each from the lid and conjunctiva, stomach, liver, small intestines, eye, and ovary. The sites to which they metastasized were 6 times to the choroid, 6 times to the optic nerve, 5 times to the ciliary body, twice to the iris, and twice to the orbit.

Although the preponderance of evidence is in favor of considering any sarcoma of the choroid as primary, one should bear in mind the possibility that it may be a metastatic lesion and search not only for a primary focus but also for multiple evidences of metastases.

Dr. Olga Sitchevska called attention to a report from the Holt Radium Institute, appearing in the *Lancet*, in which 100 cases were reviewed. Thirty-four patients had metastatic sarcoma because of removal of "birthmarks." She warned that pigmented moles which showed no active growth should never be removed for cosmetic purposes for fear of starting metastases.

RECURRENT DETACHMENT OF THE CHOROID FOLLOWING TREPHINING OPERATION

DR. JAMES W. SMITH recalled that the frequency of choroidal detachment after cataract extraction is well recognized. Bothman and Blaess reported 20 detachments in 143 eyes operated on for glaucoma. Duke-Elder considers detachment of the choroid more common after glaucoma surgery than after cataract operation. The detachment usually disappears after several days and rarely persists for

more than a month.

In the case reported six days following a trephining operation, a choroidal detachment was observed inferiorly. Reattachment took place two days later. The same phenomenon occurred in six days with restoration again in two days. Symptoms ushering in attacks were tearing, visual veiling, and distortion. The third detachment lasted only 12 hours, whereas the fourth cleared in 48 hours. The fifth and last attack occurred three months after operation, and preoperative vision of 20/50 was recovered.

For three months thereafter a convex arc of pigment granules, extending almost to the optic-nerve level, demarcated the area of detachment. Treatment was limited to continual atropine and pare-drine mydriasis.

Discussion. Dr. Ernst Waldstein stated his impression that the type of section used in a cataract extraction is greatly responsible for detachment of the choroid. His first teacher, Czermak, used a subconjunctival cataract extraction the chief features of which were a large subconjunctival pocket and completion of the section by means of special scissors. When, usually after a week's interval, the eyes that had been operated on were examined in the dark room, a large percentage were found to have a detachment of the choroid. In cases wherein the classical method with the Graefe knife was used, this percentage was considerably smaller.

Dr. Dewey Katz urged that Dr. Smith's warning regarding this condition be taken seriously, for these cases of post-operative choroidal detachment are not so benign as one may be led to believe. He recalled a case of bilateral-trephining surgery in which the choroidal detachments with their resulting absent anterior chambers persisted for several months. Dr. Katz placed himself in the group of

operators who secure an incidence of 50 percent of choroidal detachments following sclerectomy. He said he believed that the type of incision influences the frequency of choroidal detachment. His experience has been that it occurs more frequently following the various types of sclerectomy than keratome or cataract-knife incisions. He has recently gained the impression that, in the absence of other contraindications, getting these patients with choroidal detachment out of bed helps to clear up the condition. He had several cases in which the detachments disappeared and the anterior chambers were re-formed soon after the patients were allowed out of bed.

Dr. Smith did not agree with Dr. Waldstein that the type of section employed for cataract extraction will decrease the incidence of choroidal separation. O'Brien observed transient choroidal separation in 93 percent of his cataract operations performed by modern and approved methods. The statement that choroidal detachments are unimportant and that all get well without complications unfortunately appears in several textbooks. Careful review of the literature reveals that many eyes are lost following trephining operations complicated by prolonged choroidal detachment. He agreed with Dr. Katz in emphasizing that the trephine opening, by preventing early re-formation of the anterior chamber, prolongs the choroidal separation. Duke-Elder credits Bothman with the procedure of turning down a strip of superior rectus tendon subconjunctivally over the trephine opening in these cases; but he believed Magitot originated this type of repair.

THYROTROPIC EXOPHTHALMOS

DR. ISADORE GIVNER presented the case of M. J., a woman, aged 34 years, who was seen on April 21, 1944. Her past

history was not significant except for a thyroidectomy performed in March, 1943. Two days following the operation the eyes became more prominent. When seen for the first time her measurements at 105 mm. baseline were 32 mm. in each eye. Vision was R.E. 20/30, L.E. 20/100. Edema of the lids was 3+ and chemosis of the right eye was 1+. The fundi showed only retinal venous congestion. An X-ray picture of the skull showed that the sella turcica was normal in size and shape. The patient was advised to take 3 grains of thyroid daily. The basal metabolic rate was 1+.

On July 21st the patient complained of diplopia, and paresis of the right inferior rectus muscle was present. The visual fields showed a central scotoma for red in both eyes and loss of the supero-temporal field for red in the left eye.

Two X-ray treatments of 40 r each were given to the pituitary region at a one-week interval. Following this the patient's condition became worse, and the exophthalmos measured 33 mm. each eye. Visual fields now showed a temporal contraction for 3/330 white target and a central scotoma for both color and form in each eye.

On August 21st paresis of the depressors of the left eye produced a left hypertropia. The vision was R.E. 20/200, L.E. 3/200.

A Naffziger operation was performed on August 28th. The surgeon reported "little orbital fat and very great hypertrophy of the ocular muscles, which were thick and gray in appearance."

When seen at the last examination exophthalmometric measurements were 18 mm. in each eye (total reduction of 15 mm.). Vision was R.E. 20/20, visual field normal. Vision of the left eye was reduced to perception of hand movements; visual field more contracted, and optic atrophy was present. X-ray pictures of

the optic foramina disclosed that the roof of the right optic foramen had been removed while the left was still intact. This may have accounted for the continued loss of vision due to immediate increased postoperative swelling.

Discussion. Dr. Daniel Kravitz stated that in 1941 Dr. Walter Moehle and he reported two cases of exophthalmos in which the eyes were lost. At that time they divided exophthalmos into two varieties, one calling for early thyroidectomy and the other for other therapy. A great debt is owed to Dr. J. H. Mulvany for so clearly differentiating the two types. Many patients are still being operated upon whose cases have not been adequately classified, with the result that there is progression of the exophthalmos to blindness. Cases like that reported by Dr. Givner should be repeatedly presented before medical societies until the profession is well informed, and cases of exophthalmos are properly classified before operation. This will prevent many cases of post-thyroidectomy blindness.

MACULAR DEGENERATION—A CLINICAL AND PATHOLOGIC STUDY

DR. SAMUEL GARTNER described a brother and his sister who noticed the onset of poor vision nine years ago. At the ages of 47 and 45 years, respectively, they had extensive degeneration of the macula and small foci of degeneration elsewhere in the retina of both eyes. A brother, who died of influenza at the age of 31 years, had poor vision for the last few years of his life. Their parents were cousins of distant degree.

The fundi presented a very similar picture in the four eyes of these two patients. The discs were of good color and the retinal vessels appeared normal. In the macular region there was an extensive area with a gray background and a glazed surface which contained a large

number of irregular, almost black, pigment deposits. A number of smaller pigment deposits, some with a small atrophic zone about them, were found near the disc. The periphery appeared normal. In the case of the woman there were, in addition, a few blood vessels near the disc which had a collar of pigment about them.

The hereditary macular degenerations have been classified according to the age of onset, which is somewhat arbitrary, in as much as there is considerable overlapping. The pathology requires further study, for there appear to be considerable differences in the various groups.

Discussion. Dr. Arthur Linksz said that the conspicuous and very typical sheen of the whole retina in both of these patients suggested to him a heredo-degeneration of the retina rather than macular degeneration. Certainly they did not belong in the groups of macular degeneration of which Dr. Gartner presented such beautiful pathologic slides. Though the discs were of rather normal color and the retinal vessels well filled, there were enough pigment spots scattered over an intermediary area of the fundi to justify the diagnosis of atypical pigmentary degeneration. He agreed that in addition to the sheen and pigment spots there was present a special involvement of the posterior poles. This he believed can be best described as an atrophy of the posterior layers of the retina or of the choriocapillaris or both. The retinal vessels passed the sharp boundary of these lesions unhampered and the deeper choroidal layers appeared intact. However, this sharply outlined disciform lesion, while involving the macular region, was much more extensive than the macula. The male patient mentioned poorer vision in dim light, which is probably further evidence that these cases belong in the large group of so-called tapeto-retinal degenerations.

Dr. Sigmund Agatston agreed with Dr. Linksz in his impression as to the nature of the cases. He would not classify them in the same category with Tay-Sachs disease or juvenile macular degeneration but would consider them atypical central pigmentary degeneration, with normal periphery, without contracted arteries and without any lens opacity. A similar glazed pigmentary degenerative change had been observed following exposure to strong sunlight.

Dr. Gartner said the cases he demonstrated were not exactly like some of the textbook pictures. It is not especially enlightening to quibble about the terminology as the classification is based mainly upon the location of the lesions and the age of onset. The knowledge of hereditary macular degeneration is necessarily limited, since so few of these eyes have been studied histologically. The question as to whether these may be cases of atypical retinitis pigmentosa with macular involvement presents a theory with little to support it. The lesions were predominantly at the macula. The discs and the blood vessels were normal; the lenses were clear, and the peripheral visual fields were normal. It cannot be doubted that these are hereditary degenerations. The parents of the patients were distant cousins and all four eyes of this brother and sister presented a similar picture of macular degeneration.

MULTIPLE NODULAR TUBERCULOUS SCLERITIS

DR. BERNARD KRONENBERG described such a case, which has been published in this Journal (January, 1946).

Discussion. Dr. Olga Sitchevska said she reported a case of primary tuberculosis of the conjunctiva two years ago. An 18-month-old child had a lesion in the conjunctiva of the upper lid with swelling of the preauricular gland. No other tuber-

culous lesion was present in the body. Dr. Sitchevska asked whether many cases of primary tuberculosis of the sclera have been reported.

Dr. Kronenberg, in closing, stated that several cases of primary tuberculosis of the sclera have been reported, but no one has reported nodular scleritis.

LID EDEMA IN DERMATOMYOSITIS

DR. FRANK GRAUPNER presented a case of marked lid edema, of violaceous color, of nine months' duration, in a 40-year-old woman who suffered from dermatomyositis. This rare disease has hitherto been regarded as a nonpurulent polymyositis with degeneration of muscle tissue. Lately, in this country, relationship to lupus erythematosus and similar diseases has been found which would classify dermatomyositis under the vascular disorders. The findings of retinitis with exudates and hemorrhages, as in this case, would substantiate this opinion. Lid edema is one of the first signs of dermatomyositis.

MASSIVE COLLOID DEGENERATION OF THE RETINA

DR. FRANK GRAUPNER presented a nurse with unusually extreme and extensive colloid degeneration of both retinas. The vision was 20/20 in each eye.

Discussion. Dr. Ernst Waldstein said that four years ago he saw a woman, aged 48 years, who had numerous drusen in each eye, and the vision was 20/25 in the right eye. When the patient was last seen, after four years of observation, the drusen had become much more extensive and, while the vision L.E. was 20/20, that of the R.E. was only 20/70. Besides the drusen, there were insignificant pigmentary changes below the macula of the right eye. This frequently seen clinical picture, usually regarded as a harmless

affection, may, therefore, occasionally cause a serious impairment of function, apparently due to pressure of the massive hyaline concretions upon the rods and cones.

Dr. Sigmund Agatston stated that he had seen several similar cases. Some of the patients retain good vision, whereas others do not. Evidently the macula remains unaffected in some cases, just as in paramacular choroiditis.

Dr. Benjamin Esterman questioned the belief that visual impairment occurs if these lesions strike the macula, whereas it does not occur if the lesions fail to involve the macula directly. If this were true, there should be paracentral scotomas in those cases with good central vision.

Leon H. Ehrlich,
Secretary.

CHICAGO OPHTHALMOLOGICAL SOCIETY

March 19, 1945

DR. SAMUEL J. MEYER, *president*

SCIENTIFIC PROGRAM

PENETRATING INJURIES OF THE EYE: A STATISTICAL SURVEY

DR. WILLIAM F. MONCREIFF and DR. KARL J. SCHERIBEL presented a paper on this subject which has been published in this Journal (1945, v. 28, p. 1212).

Discussion. Dr. Thomas D. Allen said that he would like to know Dr. Moncreiff's indications for evisceration versus enucleation. Recently, immediate enucleation was advised on a patient seen in consultation. Evisceration was done instead, with resultant prolonged healing. It would seem that if there is no infection, enucleation is preferable because healing is more prompt. Evisceration seems to be followed by more inflammatory reaction.

Dr. Vernon M. Leech stated that he is heartily in favor of removal of an injured eye before six weeks have elapsed, if the injury is in the corneoscleral region. He said he recently had an unpleasant experience with an eight-year-old girl who suffered a 6-mm. penetrating wound in the cornea and sclera (3 mm. in each). The parents did not want to have the eye enucleated immediately, although he urged it, so conservative treatment was carried out. The wound was sutured and a conjunctival flap was drawn over it. The eye improved nicely for four weeks and both eyes were watched carefully with the slitlamp every second day. At the fifth week it looked still better, was less sensitive to light, and had good projection, so he told the parents that once a week would be sufficient for observation. The child returned to him in 10 days and at this examination, to his horror, he found in the uninjured or so-called "sympathizing" eye, a sprinkling of cells in the anterior chamber and half a dozen agglutinations on the posterior surface of the cornea. This was six and a half weeks after injury. The offending eye was removed within three hours; a week later no cells were seen in the anterior chamber of the other eye, and the agglutinations had become absorbed. The eye was saved, and visual acuity remained unimpaired. To say the least, this was "too close for comfort."

Dr. Gail F. Soper stated that it was surprising to note how many in this series were cut by spectacle glass. He had been under the impression that this was not a frequent cause of injury. He said he saw a patient a few years ago whose eyeball had been cut by glass from the rear-view mirror.

Dr. G. H. Mundt said he noted that in about 50 percent of the cases sulfona-

mides were used. He asked what Dr. Moncreiff was doing with penicillin in perforating injuries, and how they progressed in comparison with the use of other chemotherapy.

Dr. William F. Moncreiff, in closing, said the question of the relative merits of evisceration and enucleation had not been discussed in his paper, and he had nothing new to offer on this point. Aside from the obvious necessity of evisceration for panophthalmitis or severe endophthalmitis, which no one disputes, there are the extremely mutilating penetrating or crushing injuries of the eyeball in which enucleation would be technically very difficult, and evisceration is therefore more satisfactory. Of course, it is theoretically possible that uveal tissue remaining in the emissaria in these eyes may give rise to sympathetic ophthalmia, but few operators seem to regard this as an important risk.

Penicillin was not used in any case during the period of time covered by the report; during that time penicillin was not generally available for civilian use.

He emphasized that some of the data suggested that in many cases of penetrating injury, a few hours' delay in operating may be less important in the final outcome than the considered decision of a consultant of mature judgment, as to whether the nature and gravity of the injury call for primary enucleation or permit conservative surgery with a reasonable prospect of success.

CHRONIC POSTTRAUMATIC SYNDROMES LEADING TO ENUCLEATION

DR. BERTHA A. KLIEN presented a paper on this subject which has been published in this Journal (1945, v. 28, p. 1193).

Robert Von der Heydt.

AMERICAN JOURNAL OF OPHTHALMOLOGY

Published Monthly by the Ophthalmic Publishing Company

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EDUCATIONAL AIDS

In the Irving S. Cutter Memorial number of the Quarterly Bulletin of Northwestern University Medical School (1946, volume 20, number 1, page 71), there appears an article by Tom Jones, B.F.A., professor of medical and dental illustrations, University of Illinois Colleges of Medicine and Dentistry of Chicago. It is an entertaining and thought-provoking study of the use of words, pictures, slides, charts, diagrams, models, specimens, and motion pictures as teaching media in medi-

cal education. The author emphasizes the "gain that results from their coördinated teamwork." He points out that the "progress in the development of visual aids to teaching has been so rapid within the last few decades that it has outstripped our ability to understand them or to use them effectively and also to comprehend their full relation to medical education. . . . A very large number of teachers in medical schools are lagging behind in their knowledge and utilization of visual teaching technics." He pleads for what might be

termed the creation of an environmental aura of visual stimuli to foster chains of association which would require both an unconscious and conscious effort. In other words, blank wall spaces in the halls, class and lecture rooms, and in laboratories should be covered with teaching charts, photographs, diagrams, and so on.

Nearly every teacher for centuries has been aware of the value of visual aids in carrying his ideas across the average high threshold of resistance put up by the pupil. The living subject used in clinics, the lantern slides and motion pictures shown in lectures, charts, diagrams, and models displayed in exhibits, and so on, have been universally used with advantage for all purposes, from selling of a commercial article, particularly stimulating in the territories of hosiery and lingerie, to mortuary displays as well as in strictly educational ventures. In fact, visual aids are used to demonstrate the use of visual aids. No matter where we turn in these days, vigorous visual aids as also auditory ones clamor for our attention, more or less stridently, in more or less good taste, and more or less off-color. So there must be something to the idea. Most children know more about the comic-strip characters Li'l Abner or Blondie, than they do of Abraham Lincoln.

The Army and Navy used visual aids in all their training courses, no matter what the subject, and with great success. It was found that much more could be taught in a shorter time and retained longer through motion pictures, especially sound-recorded, and particularly if there was a bit of humor added somewhere.

This is not to belittle the use of visual aids. Far from it. The medical teacher should become acquainted with all media and learn to integrate them to the best advantage.

It is important here to note the plans

recently set afoot by the American College of Surgeons to sponsor and support a program to develop teaching films on all surgical subjects, including ophthalmology. The plan is a 10-year one, it is expensive and painstaking, but if it is successful, as no doubt it will be, the program will have enormous reward.

There is developing a new commercial profession in our midst, that of "visual aider." It may rival that of radio, some day, and undoubtedly will be hitched to television too. The medical educator should not scorn these, often garish, techniques, but should be placed in the way of becoming acquainted with them in order to utilize them in his teaching more effectively than in the past.

An institute of visual aids for the teaching of ophthalmology would be a great boon. Material could be devised, collected, and distributed, and the words and deeds of great ophthalmic surgeons and teachers could be made available to all medical schools almost on the instant demand. The American College of Surgeons is taking a great step forward in this direction. The Academy of Ophthalmology and Otolaryngology and the American Medical Association also play an active role, although probably unconscious of the ultimate goal at the moment.

But is it necessary to await the founding of such an institute? Since this medium was added the motion-picture programs of the conventions of the Academy and the American Medical Association have been their most attractive features. The pictures have been, as a rule, cleverly devised to demonstrate some particular point or other. Perhaps some of these films were amateurish, but one can see a calculated and, at times, a decidedly professional touch forming.

There is also a collection of surgical films made by the Army and Navy during the war. Many of these are splendid. If

the responsible authorities as well as authors of private civilian films would deposit copies, say in the College of Surgeons or, preferably, in the Army Medical Museum, starting right now, an immediate and impressive collection could be made, and methods of distribution on a loan basis could be set up. Not only films and pathologic slides, but also lantern slides, copies of diagrams and charts, and so forth, could be made available to teachers, medical societies, and ophthalmologic clubs, either for the asking or for a small fee.

The quality of the various forms of visual aids is steadily improving, due to new developments, inventions, materials, and techniques. The art of the preparation of a proper and dramatic scenario is sweeping forward in extraordinary waves. Ophthalmologic societies and teachers need to be informed and kept up to date on these things. Why not establish a joint ophthalmologic committee to investigate these advances, publish frequent reports, and help to keep us so informed?

Derrick Vail.

CORRESPONDENCE

REPORT ON II PAN-AMERICAN CONGRESS OF OPHTHALMOLOGY*

Montevideo, Uruguay—November, 1945
Editor,

American Journal of Ophthalmology:

It has been a bit difficult for me to decide what sort of picture to paint for you. Conventions come and go; they have many features in common, yet they have—if they amount to much—one or more unique characteristics. It would be impossible for me to abstract the papers; I have a few abstracts, but they are not very illuminating nor revolutionary. Most

of the papers were given in a foreign language, and I must confess I didn't understand very much of what was said. But the general over-all atmosphere, the good comradeship, the setting, the personalities, the hospitality, the *esprit de corps*, the earnest seriousness of the delegates, both young and old, to give their best—all of these were most noteworthy.

We think in terms of the Academy and the American Medical Association. These organizations have been active for many years. Can you imagine attending the *first* Academy meeting or the *first* interstate ophthalmological meeting? That is just the sort of meeting this convention was, for here at Montevideo, Uruguay, the professors and practicing ophthalmologists of the Latin-American countries met as a group on a common ground for the very first time in history! True, this was the II Pan-American Congress of Ophthalmology, but the I Congress was held in Cleveland, in 1940, and only about 20 Latin Americans were present. In Montevideo there were over 140. The first Congress was very far from their home; to the Latin Americans from, say, Uruguay, Chile, or Argentina, the trip to the United States was as formidable as a trip for us from here to South Africa, for the transportation was decidedly more difficult then than it is now, and their finances, in general, are not, and have not been, so good as ours.

The amazing discovery I made was that until recently it has been much easier to go from Buenos Aires to Lisbon, Paris, Rome, and London than to any part of the United States, and almost as easy to go from Santiago and Lima to Europe as to the United States. Furthermore, the Andes form an almost impassable barrier from the West Coast to the East Coast; consequently, the crossing was a most rare occasion, and had never been undertaken by any large number of ophthalmologists.

* Read before the Chicago Ophthalmological Society.

This was, therefore, the very first time East met West in South America, and seldom before did any single ophthalmologist go from Central America to South America; or vice versa. Why should they? What could "the foreigners" give them? Why shouldn't such time be spent in well-known centers of learning in Europe?

A word now about the formation of the Pan-American Congress. It was an outgrowth of the International Congress in Cairo, 1936. There Harry Gradle met Moacyr Alvaro, and they, with a few others concurring, proposed an attempt at uniting the ophthalmologists of the Americas. They realized Europe was ripe for self-destruction and that the Americas must depend upon each other for the preservation and advancement of the knowledge and science of ophthalmology.

You know with what success the I Pan-American Congress was held—yet it was attended by very few from Central America and South America. The papers were briefed and *read* as briefed, the translation being thrown on the screen for the benefit of those who had language difficulties.

One disadvantage of this method was that the audience could not take home with them more than a memory, and that often inexact, of what was said.

This time the officers decided to have the papers abstracted and the abstracts *printed*, so that we could read what the author said, both before and after the presentation. We wished they had attended our Academy meetings and copied our Academy procedure; namely, the use of the blackboard to announce the speaker and his topic. Personally, I think a combination of the two methods would work out better, for I found it extraordinarily difficult to sit through several hours of a session in which I often didn't know even which paper was being presented. This is

not a true measure of my intelligence, because (1) the program was not followed exactly, (2) practically all announcements were made only in Spanish, with little consideration for the few of us from the United States.

However, we could not miss the impact of personalities, their earnestness, their enthusiasm, their camaraderie. Two of the Kellogg-fellowship graduates of the Illinois Eye and Ear Infirmary were there—Daniel Silva of Mexico City and Manuel da Silva of São Paulo—also, several who had trained elsewhere in the United States. There were older men there, too; forceful leaders in their respective communities. I should like to mention and characterize all of them, but that would be impossible. Some of those who particularly impressed me I had met before, in or from Mexico City, Guatemala, Lima, Santiago, Buenos Aires, Montevideo, São Paulo, Rio de Janeiro, and Havana. We all know and love Moacyr Alvaro, who has visited Chicago on numerous occasions.

Dr. Alvaro speaks our brand of English, except when he is with an Englishman, French when he is with Frenchmen, Spanish when he is with those who speak Spanish, and Portuguese when he is at home. And I've been told that he is almost as fluent with German and Italian. He has a marvelous memory, a clear mind, and a facile tongue.

Some of you will remember Dr. A. Torres Estrada of Mexico City, who has attended one or two Academy meetings. He is a short, well-built man, somewhat retiring, but a most genial personality, who impresses one with the fact that he knows ophthalmology and has a lot of ability, skill, and diplomacy.

Tomas Yanes of Havana, Cuba, headed the Cuban delegation. He, also, is a frequent visitor to the States, and is a member of the Academy. He is a human

dynamo. His Spanish is so soft and fluid, it flows off his tongue. His hands and heart are in every word. He is dynamic, but he is so very careful not to hurt the feelings of anyone. He was accompanied by Dr. Branly, and together they saw to it that Cuba was chosen for the next meeting.

A. Vázquez Barrière of Montevideo was the president of the executive committee. He is large, genial, punctilious, efficient, quiet, with an old-world dignity that cannot be ruffled. He had two right-hand men: one his son, tall and stately, the counterpart of his father; the other, the secretary general, R. Rodriguez Barrios, a most affable man, who was never in a hurry, but was always everywhere, oiling the machinery, aiding here, directing there, and crazy to learn. He spent a great deal of time with us North Americans and thanked us profusely for talking to him in English. One should watch him for important advances in ophthalmology.

R. Pacheco Luna had left Guatemala City the day before we arrived there, but we thoroughly enjoyed him in Montevideo. He is one of the strong men in ophthalmology and intensely interested in the integration and strengthening of the bonds between all the Americas.

There were so many great men there about whom I should like to tell you, but time does not permit. However, I must mention J. Valdeavellano, a man of small stature, whom you must know to appreciate; but the more you know him the greater is your respect and admiration. He is the Professor of Ophthalmology in the oldest university in the Western Hemisphere, at Lima, Peru. His spoken English is not very good as yet, but he speaks French and German with ease. He is a young man, with great ability. Let me say here that if we would only learn Spanish and read some of their periodicals and books we would find that

they are by no means behind us, except in numbers of talented men. This defect they are slowly remedying.

The delegation from the United States consisted of: Mrs. Merrill Brown, National Society for the Prevention of Blindness; Lieut. Comdr. Griffey from the Department of State; Capt. C. A. Swanson, U. S. Navy; Dr. Conrad Berens, Dr. Joseph Pascal, and Dr. Ramon Castroviejo of New York City, Dr. Paul Tisher of New Britain, Conn., and myself.

Most of the Argentinians absented themselves because they felt that coming from a dictatorship country, they could not conscientiously attend a democratic congress. On our way down, we had stopped in Buenos Aires (B. A. for short), for several days, and there became acquainted with several outstanding men, one of whom, Dr. Francisco Belgeri, had a very prominent part in the Congress. He was distraught because the political situation in Argentina was so bad that the doctors had agreed not to leave the country at this time, even to go across the river Plata.

The setting for the Congress was marvelous. Consider, if you will, 140 delegates and about 60 wives, taking over a large hotel at Atlantic City or Coronado Beach; only our beach was six times as wide and very much longer, and there is *no boardwalk!*

The Uruguayan government was so interested in making the Congress a success that they made an extraordinary arrangement with the Hotel Miramar to have it opened for us just before the summer season; they arranged for all delegates to have a special rate—we paid for the rooms, and the government for the food (*but not the drinks*). The evening meal was almost always a banquet. And such food! It was better than first-class passage on a transatlantic liner! In addition, the president of the Republic, Juan Jose

Amezaga, presided at the opening session and honored us with his presence at a lavish cocktail party given by the Uruguayan Ophthalmological Society. The hotel was about seven miles from the center of the town, and buses ran every 30 minutes, and taxis whenever you wanted them. The country is not too flat, but there are no real hills; that is, it's slightly undulating. The weather was not too hot, and it didn't rain too often—usually at night. The water was a little chilly but invigorating, and an early morning walk or sprint along the beach, followed by a dip in the salt water, made a perfect appetite for breakfast and gave zest to the opening of the new day, even after a late banquet.

The meal hours were something! Breakfast in your room whenever you wanted it. Luncheon at any time from 12:30 to 2:45; cocktails at 7 or 8 o'clock; dinner at 9 or later.

The Inaugural Session, held in the Senate chamber was very impressive. The President of the Republic and most of his executive officers were on the dais, and the officers of the Congress, just below on the platform. Midway, and to the left, on another elevated platform, were the ambassadors of all the countries represented by the delegates. We delegates were scattered about in the seats of the senators.

We heard a few words from the Minister of Public Instruction and then, both in Spanish and English, remarks from the President of the Pan-American Congress. I am sure you will want to hear what he said, for it "caught fire."

Dr. Harry Gradle's Presidential Address

"This, the second meeting of the Pan-American Congress of Ophthalmology, marks an important epoch in the history of ophthalmology in the Americas. For two years this has been postponed, not only because of travel conditions imposed

by the war, but even more because of the handicaps upon science that unleashed brutality produces. But now we can gather in quiet and peace to describe and discuss how best we, the ophthalmologists of the Western Hemisphere, may aid our people, and it is solely for that purpose that the Pan-American Congress of Ophthalmology exists.

"But a forum of this character must be more than merely a meeting place for the exchange of scientific ideas. To be of real value to all of its members, there must be constructive aspects that will tend to advance the science of ophthalmology in all parts of the world inhabited by members of the P.A.C.O. The constructive phase of the Society cannot be confined to the time of the meetings alone, but must live with the members day by day, and night by night. It must be a power, a force, whose sole object is the advancement of the science of ophthalmology, and to which the members can turn as necessary. Your Officers of the P.A.C.O. are endeavoring to supply that force by Ophthalmologia Ibero-Americana, by the Kellogg—Pan-American Fellowships in Ophthalmology, and by the work of the various committees whose reports you are to hear within the next few days.

"By practical experience in the United States of America and in Brazil, it has been found that the most potent factor in the elevation of the standards of ophthalmology is the existence of a joint Board for the purpose of setting up such standards and for the voluntary examination of men who wish to be recognized by their fellows as qualified in ophthalmology. To that end, I propose the development of a South American Board of Ophthalmology, dedicated to the elevation of the standards of training and of the practice of ophthalmology. Such a Board should, of course, be an independent institution, originated by the educa-

tors in ophthalmology, and supported by all of the local and national ophthalmological societies. Each country should be represented by elected representatives in the proportion of one for each 100 ophthalmologists in the country. The Board should meet once a year and determine which of the applicants from all the countries are eligible for examination. Then the examination should be determined upon, and, upon his return home, the examination should be given in each country by the elected representative, assisted by as many ophthalmologists as he may deem necessary. Only those candidates approved by the General Board should be eligible for the examination. Upon successful completion of the examination, a certificate should be granted by the Board, and eventually such certificate will be required for appointment to hospital or university positions."

Dr. Conrad Berens then gave a few very appropriate remarks about the pleasure we English-speaking delegates had at being present.

After a short intermission, we reassembled in executive session, where committees were appointed and minor business transacted.

Some papers prepared by delegates who could not get there were read by others; for example, Saul Sugar's paper on "Gonioscopy and gonimetry," Harry Gradle's on "Preglaucoma," Peter Kronfeld's on "New viewpoints on glaucoma derived from gonioscopy," and George Guibor's on "Surgical treatment." One paper was given in French. During one of the later sessions Dr. Arruga arrived from Barcelona; he was at once ushered to the platform, and the meeting was his. He is a most attractive person, a typical Latin gentleman, always at ease, but you can see fire in his eyes.

We have much to learn about entertaining foreigners and about the value of ambassadors and consuls; for example,

the Cuban delegation came, for the most part, as representatives of the Cuban government. Their president is a physician, a friend and patient of Dr. Yanes. They were most anxious to make an impression upon the ophthalmologists of the Americas. They advertised Cuba everywhere and all the time. The newspapers gave them considerable space. They also went down the West Coast and back up the East Coast. Everywhere they went they entertained the local ophthalmologists, with the help of their ambassadors, and were, in turn, entertained. It was a veritable triumphal procession. Dr. and Mrs. Tisher and Mrs. Allen and I were included as soon as we caught up with them at Lima, Peru. It was a party here, a banquet there, tea or cocktails, or a reception, a dedication of a plaque in honor of a local ophthalmologist, or a launch trip around some interesting islands, a trip to a new clinic, or hospital, or simply a shopping trip for ladies.

It is my impression that things went smoother, and we became better acquainted because the women went along. The men swapped professional experiences and the women family topics, the result being a warm "simpatico" relationship, which is so very valuable south of the Rio Grande.

Our travel time was so arranged that we never flew two days in succession, except in one instance, but had one to four days' rest between flights. For example, we had time in Merida, Yucatan, to go out to see the old Mayan temple ruins (pyramids) at Chi-chi-nitza. We met Dr. and Mrs. Tisher in the plane, en route to Guatemala. We had a good time in Guatemala City, not only to visit with Dr. Quevedo, but also to see the religious rites of the Indians up in the mountains at Chi-Chi-Castenango. We visited the Gorgas Hospital and the leprosarium at the Canal Zone, where Dr. Robinson Har-

ley, a student of William Benedict, was our host.

It was in Lima we expected to rest up, but we were on the go every minute, till we nearly dropped. There was a special Ophthalmological Society meeting an hour after our arrival. This was followed by a banquet that lasted till well past midnight. The Cuban ambassador, Dr. Rodriguez, and his wife, a most charming American woman (she, by the way, was the surgical nurse of the Columbia University Eye Department), were there. The next morning we went to several clinics, most modern in every respect, while the ladies shopped; country club for lunch, then the Anglo-American Hospital, then tea and cocktails, then a private banquet at Professor Valdeavellano's home, where we were overpowered by the importance of the other guests, the beauty of the home and garden, and by the repast, which outshone any smörgåsbord anywhere. Early the next morning (I don't know when those South Americans sleep), they called to take us to the oldest university in the Western Hemisphere, and the museum. Then a quick lunch (6 courses—1 hour, 30 minutes). Time out here for one hour of shopping, then tea; then dress for another private dinner.

The next day Dr. J. Raffo, who had studied with Drs. Benedict, Wheeler, and Berens, took us on a motor launch out of the harbor, at Lima, around some very imposing islands. On the far side, basking on projecting rocks, were thousands of sea lions and millions of birds. They told us that when the droppings become 10 to 12 inches deep, it is worthwhile to mine the guano for fertilizer.

After the Congress, we spent four days in São Paulo, where Dr. Alvaro was a most thoughtful host. We were shown the city, both by day and by night; his home, his office, and his clinics were most attractive. Like Rome, São Paulo is situated on many hills. It is a city with character; and

the people are much as we are—ambitious, energetic, and forward-looking.

On the way home from Rio, I went up the Amazon about 1,000 miles to see what is being done by the Institute for Inter-American Affairs to assist the Brazilians in modern sanitation, the prevention of disease, and the keeping of vital statistics. I spent nearly 24 hours on a launch on the broad waters of the Amazon, and then a day in a town, Itacoatiara, about 150 miles downstream from Manaus, where no doctor has ever lived.

We visited with Dr. and Mrs. Perret-Gentil in Caracas, Venezuela, a beautiful town, over 3,000 feet above sea level, where the houses cling to the side of the mountains, the air is invigorating, and the people most industrious. And finally, on our return, via Miami, we had a most friendly visit with Dr. and Mrs. Nelson Miles Black.

(Signed) Thomas D. Allen, Chicago

YOU'VE LOST AN EYE! SO, WHAT?

Editor,

American Journal of Ophthalmology:

"The loss of an eye is not so much of a handicap as might be supposed."

However surprising and apparently paradoxical the statement, coming from a lady of quality who is an authority of experience and standing, it deserves respectful consideration as a contribution to clinical and social ophthalmology. When such information brings with it constructive counsel and a humanitarian appeal of the highest spiritual significance, any hesitation to accept and approve wholeheartedly must seem narrow-minded if not antisocial. What indeed could touch us more deeply than a call for common effort to spare the partially blinded soldier any additional hurt, any lowering of morale, any hindrance to rehabilitation.

It at once arouses our sympathy and enlists our full support. However, there are implications in Lady Duke-Elder's thesis which in all conscience call for further consideration.

Monocular blindness is not a war casualty alone. It is, unfortunately, all too common in industry, in sports, in traffic, even in the home, and in every case presents a continuing hazard of total and irremediable blindness.

The prime desideratum, here, is the prevention, if possible, of any further loss of vision by injury. This calls for intensive warning of individuals and groups, the inculcation of caution, insistence on the use of protective appliances and precautionary measures, a campaign of legitimate propaganda for community eye-safety. To play down the loss of an eye is to discount our moral responsibility, it does marked disservice to this sight-saving project and, indirectly, to every potential victim. There are factors of safety in most ocular hazards. The double representation of the eye is one, perhaps the most important one. Its loss will not be regarded lightly when "there is only one eye between you and total blindness." That loss of the remaining eye due to injury is statistically infrequent offers little consolation to the individual victim. The favorable (?) figures may be explained. "Once bitten, twice shy." The one-eyed operative avoids reemployment in a hazardous trade and

uses every protection and precaution available.

The visual field and safety. The claim that only one fifth of the field is destroyed when an eye is lost, while mathematically tenable is hardly fair when it ignores the complete loss of an invaluable safety factor; that is, vision on one whole side. This field with its highly developed sense of motion is of paramount importance in warning of danger from moving vehicles and flying missiles, approaching from the side (far off center) and even a bit to our rear. It is true that we can turn the one remaining eye and the head whenever we wish to look into the "lost" area, but unless a danger signal makes this adjustment instinctive and instantaneous, it is of no value whatever as a factor of safety. In lower animals the eye is located well to the side of the skull, and the entire monocular apparatus, left and right, is available as a lookout for trouble. In man, the eyes have come to the front, and the temporal field alone, of each eye, becomes the guardian angel of sight and safety. The loss of this protective factor now constitutes an actual hazard.

These considerations should lead us to the all-important work of conservation of vision and the prevention of blindness, while we still hold to the high purpose imposed by Phyllis Duke-Elder's stirring appeal.

The loss of an eye is, indeed, "as much of a handicap as might be supposed."

(Signed) PERCY FRIDENBERG, New York

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. General methods of diagnosis
2. Therapeutics and operations
3. Physiologic optics, refraction, and color vision
4. Ocular movements
5. Conjunctiva
6. Cornea and sclera
7. Uveal tract, sympathetic disease, and aqueous humor
8. Glaucoma and ocular tension
9. Crystalline lens
10. Retina and vitreous
11. Optic nerve and toxic amblyopias
12. Visual tracts and centers
13. Eyeball and orbit
14. Eyelids and lacrimal apparatus
15. Tumors
16. Injuries
17. Systemic diseases and parasites
18. Hygiene, sociology, education, and history
19. Anatomy, embryology, and comparative ophthalmology

1

GENERAL METHODS OF DIAGNOSIS

Agundiz, Teodula, Jr. **Clinical applications of angioscotometry.** *Bol. del Hosp. Oft. de Nuestra Señora de la Luz*, 1945, v. 3, May-Aug., pp. 33-49.

The scope of this article covers technique (which includes a great deal of patience); vascular structure of the retina; and consideration of other anatomic details. (9 figures.)

W. H. Crisp.

Della Casa, F. **An adaptometer for the general practitioner.** *Ophthalmologica*, 1943, v. 106, Sept.-Oct., p. 143 and p. 189.

Increased night traffic makes the testing of dark adaptation desirable. The author describes a simple adaptometer that is sufficiently exact for the general practitioner and not expensive. The instrument consists of a horizontal hollow cylinder which is black on the outside and white on the inside. On the inside of the rear wall is a Landolt ring that can be turned. The front wall has

a horizontal slit through which the patient looks into the cylinder. Light from an enclosed lamp is admitted through openings in the top, and the illumination can be varied between 570 and 0.05 Hefner units. The instrument and its parts were standardized by the Swiss Federal Office for Weights and Measures. Preadaptation is made on the instrument itself. The author discusses the literature on the subject of adaptometers and compares his instrument with existing ones. He also observes that dark adaptation is delayed in one-eyed people and the aged. (Bibliography.) Max Hirschfelder.

Evans, J. N. **A visual test for infants.** *Amer. Jour. Ophth.*, 1946, v. 29, Jan., pp. 73-75.

Friedman, Benjamin. **Measurement of relative exophthalmos by roentgenography.** *U. S. Naval Med. Bull.*, 1945, v. 45, Sept., p. 482.

The details of a method for measurement of relative monocular exophthalmos by the X ray are described. Contact

lenses with central lead dots are used. The position of the patient's head is precisely controlled while the Xrays penetrate at an angle of 35 degrees. The relative positions of the projected shadows of the dots indicate the presence and degree of monocular exophthalmos. Changes in a progressive exophthalmos can thus be measured and recorded. The method is of no assistance in measuring bilateral exophthalmos.

Morris Kaplan.

Losada, J. Colloidometry of the anterior chamber. Arch. de la Soc. Oft. Hisp.-Amer., 1945, v. 5, Jan., pp. 43-45.

The determination of the albumin content of the aqueous is of diagnostic and prognostic importance. The concentration of albumin is measured by the colloidometer of Rønne combined with the slitlamp. The colloidometer consists of a Recoss disc which carries a series of gray glasses of different transparency graduated from 0.25 to 3.50 photopters. The upper one fifth of the slitlamp beam is left unobstructed by the glasses. The tone of the unobstructed light passing through the cornea is the standard. By selecting the proper glass the tone of the light passing through the aqueous is made to match that of the light passing through the cornea. Each glass has a value in photopters which indicates the concentration of albumin in the aqueous.

J. Wesley McKinney.

Wagenaar, J. W. A simple method for viewing the fundus stereoscopically without a stereoscopic instrument. Ophthalmologica, 1943, v. 105, Jan., pp. 13-23.

The author demonstrates that one can see the fundus binocularly and stereoscopically by means of indirect

ophthalmoscopy and a 20-diopter lens. The ophthalmoscopic mirror must be held between the eyes of the observer, and the observer must turn his head slightly in order to bring his optic axes nearer together. The geometric optics of this arrangement is discussed. The author also describes a new method for binocular observation of the fundus by means of two interlocked electric ophthalmoscopes.

Max Hirschfelder.

2

THERAPEUTICS AND OPERATIONS

Ahmed, N. Sulfonamide amblyopia and its treatment with nicotinic acid. Indian Med. Gaz., 1945, v. 80, March, p. 146.

Two cases of optic atrophy following the administration of sulfonamides are described. Both patients received large doses of nicotinic acid by mouth and intramuscularly. The patient who received this treatment promptly after the onset of the disease made a rather satisfactory recovery whereas the other was not benefited after a delay of five months. The author suggests that the sulfonamides inhibited the synthesis of vitamin B in the intestines.

Morris Kaplan.

Bentley, Neil. Penicillin in ophthalmology. Jour. Mich. State Med. Soc., 1945, v. 44, July, p. 706.

In selected diseases the effects of penicillin are amazing. In cases of orbital cellulitis, thrombophlebitis, and meningitis it surpasses expectations; in uveitis it does not seem to be of much value. In conjunctivitis of a stubborn nature it is worthy of trial.

In the limited experience of the author, local use is often followed by dermatitis of the eyelids. However, it has been successfully used by many for

blepharitis and conjunctivitis. As yet no ointment has been developed that retains its potency.

Theodore M. Shapira.

Blok, C. J. Eye ointments and their therapeutic effect. *Ophthalmologica*, 1943, v. 106, Aug., pp. 57-65.

Blok criticizes the usual emulsion of the "water in oil" type as a vehicle for drugs in eye ointments. He experimented with emulsions of the "oil in water" type and prefers vehicles of a mucous consistency, such as 3-percent tragacanth and 2-percent pectin. Drugs, particularly alkaloids, pass into the eye more readily from such a vehicle, and their concentration may therefore be very much less. The author also stresses the advantage of an alkaline reaction of the ointment, which can be brought about by adding boric acid and sodium biborate to the mixture. An ointment which contains 0.2-percent pilocarpine in an alkaline tragacanth base was as effective as the 2-percent concentration in the usual media.

Max Hirschfelder.

Buerki, E., Schmid, A., and Saubermann, G. Experience with cibazol in ophthalmology. *Ophthalmologica*, 1943, v. 106, Sept., pp. 113-135.

The sulfanilamide preparation, cibazol, was given to 340 patients in the eye clinic in Basel. The preparation was used locally in a 10-percent ointment and internally. The treatment was effective in erysipelas, ophthalmia neonatorum, serpiginous ulcer, catarrhal corneal ulcer, phlyctenular keratoconjunctivitis, gonorrheal iritis, and certain intraocular infections. It was less effective in lid abscess, chronic and phlegmonous dacryocystitis, blepharitis, and pneumococcus conjunctivitis. The drug had no value in rheumatic and

tuberculous iritis, nor in conjunctivitis caused by diplobacilli or trauma. No significant ill effects from the medication were observed.

Max Hirschfelder.

Buerki, E. The therapeutic use of Privin (Ciba) in ophthalmology. *Ophthalmologica*, 1942, v. 104, Nov., pp. 254-263.

Prievin (Ciba) is naphthyl-methylimidazolin-hydrochloride. It causes constriction of blood vessels, but, unlike adrenalin and ephedrine, this effect is not followed by hyperemia. In the eye clinic at Basel the drug was effective in acute and chronic conjunctivitis and in posttraumatic and postoperative irritative conditions of the anterior segment. It can be used with zinc sulfate, colloidal silver preparations, and local anesthetics.

Max Hirschfelder.

Dean, M. On the use of atropine in postoperative hyphemas. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, pp. 46-49.

The author reports two cases of severe hyphema which failed to show any evidence of absorption until atropine was discontinued. The hyphema then cleared up rapidly. Atropine may promote intraocular hemorrhage by a combination of peripheral vasodilation and individual sensitivity.

J. Wesley McKinney.

Dejean, C. and Roux, N. Bilateral contracture of accommodation by abuse of sulfonamides. *Bull. Soc. d'Opht. de Paris*, 1939, Oct.-Dec., pp. 582-584.

A temporary myopia due to bilateral spasm of the ciliary muscles developed as a result of intoxication from sulfonamide medication given for a gonorrheal infection. An excess of sulfa

drugs, like eserine, can produce a spasm of accommodation.

Morton R. Cholst.

Erpf, S. F., Dietz, V. H., and Wirtz, M. S. Prothesis of the eye in synthetic resin. Bull. U.S. Army Med. Department, 1945, v. 4, July, p. 76.

The authors feel that an artificial eye can be fitted readily by the dental officer in coöperation with the medical officer. They describe a simple method of fabrication which is based on research conducted by the medical department of the U.S. Army.

The advantages of a plastic prothesis over a breakable glass one are discussed. A plastic prothesis is easier to replace and can be made without expert skill. The substance used is the basic synthetic resin, methyl methacrylate, which is easily obtained and easily handled. The entire method is described clearly and completely.

Francis M. Crage.

Greenberg, M. M. The use of acrylics for enucleation with implant and as a temporary prosthesis. The Military Surgeon, 1945, v. 96, March, pp. 269-271.

Acrylics, which are light, hard, organic plastic substances and produce no reaction when buried in tissues, are ideally suited for implantation into the orbit. The author uses a grooved hollow sphere, 16 mm. in diameter and 2 mm. thick. The sphere weighs less than a glass sphere of equal size, withstands pressure of 150 pounds, withstands rapid changes in temperature, is readily sterilized, and is not apt to be expelled by the tissues. (Bibliography.)

Melchior Lombardo.

Kohout, J. J. Diathermy tip for retinal operations. Bull. U.S. Army Med. Dept., 1945, v. 4, July, p. 10.

Standard electrocoagulating units in many of the Army hospitals do not have electrodes satisfactory for ophthalmic work. Captain A. G. De Voe of the Medical Corps has devised a perfectly satisfactory tip which can be used directly with the electrocoagulating unit in the usual surface and penetrating diathermy for retinal detachments. It is made of 2-mm. capillary glass tubing and the fine steel wire that is supplied as a stylet for 22-gauge, 3-in. hypodermic needles. Platinum and tantalum have no advantages over this steel tip. It is easy and economical to make, and sparking has not been excessive nor detrimental.

Francis M. Crage.

Kohout, J. J. Prosthetic device for support of eyelids. Bull. U. S. Army Med. Department, 1945, v. 4, July, p. 117.

When an eye and the lower lid are lost, the swollen, unsupported upper lid, which is frequently without levator support, becomes increasingly disturbed in function. When a lower lid, dislocated by division of the inner canthal ligament becomes adherent to the maxilla, through scar tissue, the upper lid becomes edematous, and its metabolism is disturbed. The author describes a method for making an acrylic prothesis which is designed to support the upper lid until the tissues have recovered to a stage where plastic surgery is possible. Francis M. Crage.

Lutman, F. C. Tendon-transplantation technique for external-rectus paralysis. Amer. Jour. Ophth., 1946, v. 29, Jan., pp. 88-90.

Paton, R. T. Sight restoration through corneal grafting. Sight-Saving Rev., 1945, v. 15, Spring, p. 3.

The author discusses keratoplasty for the laity. The history and the nature of the operation, the causes of corneal opacities, the types of eyes which are operable, the results, and the method of preserving the donor eyes are described. The aims, hopes, and objectives of the newly formed Eye-Bank are discussed. The author estimates that of the 250,000 blind in the U.S., 10,000 to 15,000 could have their sight improved through keratoplasty.

Morris Kaplan.

Pickerill, H. P. **Method and appliance for grafting eye sockets.** Brit. Med. Jour., 1945, April 28, p. 596.

To avoid the almost insuperable difficulty of having a special eye made for every grafted socket, especially those following gunshot wounds, the author has devised a method for making a perforated acrylic mold of the socket. The mold is made from a cast slightly larger than an ordinary stock eye, and is made with two openings. One opening at the site of the pupil of the final prothesis serves to fix the peg which holds the mold in place while the underlying graft heals in the previously prepared orbital socket. Later the peg is removed and the socket is irrigated through the same opening. The second opening in the mold serves as a channel of escape for the irrigating fluid and secretions.

Francis M. Crage.

Sanders, N. W. **Treatment of a perforating corneal wound with penicillin and sulfadiazine.** Jour. Amer. Med. Assoc., 1945, v. 127, Feb. 17, p. 397.

The author describes a case of a perforating injury of the cornea which was seen after four days when a well-developed enophthalmitis was present. Huge doses of sulfadiazine and penicillin were given intramuscularly, topical-

ly, and subconjunctivally. After recovery the visual acuity was 5/200.

Morris Kaplan.

Schmelzer, Hans. **The problems of ocular tuberculosis and its treatment.** Arch. de la Soc. Oft. Hisp.-Amer., 1945, v. 5, Jan., pp. 24-42. (See Section 17, Systemic diseases and parasites.)

Sedan, J. **Lutazol chemotherapy of trachoma.** Ann. d'Ocul., 1941, v. 177, no. 8, pp. 283-300.

Lutazol, a salt of acid para-sulfamido-phenyl-azosalicylate, was injected subconjunctivally in 7.5-grain doses for six injections. A preceding anesthetic injection of butylline or cocaine was used without adrenalin. Lutazol was also administered internally. Thirty grams were given in ten days. Three methods of administration were used: injection and ingestion, injection, and ingestion. The first method is preferred. The average duration of treatment was three weeks. Practically all stages of the disease were represented in patients treated, and all were inactive at the completion of the treatment.

Chas. A. Bahn.

Selinger, Elias. **Dermatitis of the lids from penicillin.** Jour. Amer. Med. Assoc., 1945, v. 127, June 9, p. 437.

In a case of contact dermatitis of the lids following instillation of a rather weak penicillin solution it was interesting to note the absence of reaction of the conjunctiva. Healing was prompt upon removal of the drug.

Morris Kaplan.

Simpson, D. **The cautery in plastic operations on eyelids.** Brit. Med. Jour., 1945, Sept. 29, p. 424.

The author uses the cautery for the correction of ectropion, entropion, sym-

blepharon, distichiasis, and ptosis. The treatment for these lid disorders is multiple puncture with a small, redhot point. The resultant scar tissue corrects the defect. Actual cautery of the hair follicles in trichiasis is recommended.

Morris Kaplan.

Thorpe, H. E. Nonmagnetic intraocular foreign bodies. *Jour. Amer. Med. Assoc.*, 1945, v. 127, Jan. 27, p. 197.

The author discusses methods of removing nonmagnetic bodies from all parts of the eyeball. A careful history and an examination of tools and metals used at the time of injury will usually determine whether the foreign body is magnetic. He urges the use of the X ray when there is any question of intraocular foreign body and highly recommends the Berman locator. The author describes in detail his preparation of the patient before surgery and his post-operative care, which routinely includes the use of foreign protein and sulfadiazine. He uses stenopeic spectacles after transcleral wounds posterior to the ora serrata. The use of the Thorpe ophthalmic endoscope for foreign bodies in the vitreous is described in detail. (Diagrams.) Morris Kaplan.

Tooke, F. T. Penicillin in ophthalmology. *Canadian Med. Assoc. Jour.*, 1945, v. 53, Oct., p. 373. (Round-table conference.)

A round-table discussion on clinical effects of penicillin in the eye is presented. The properties of the drug are described, and a list is given of those organisms which are affected by penicillin and those which are resistant to it. Noteworthy among the insensitive organisms is *Staphylococcus albus*. It is interesting to note that in ophthalmic diseases therapeutic response was

uniformly good, despite a wide variation in the dosages of the drug.

Morris Kaplan.

Townes, C. D. Surgical treatment of heterophoria. *Trans. Amer. Acad. Ophth. and Otolaryng.*, 1945, July-Aug., pp. 338-346.

Two hundred and eleven operations were performed upon 135 aviation cadets for the correction of disqualifying heterophorias. One hundred and one operations were performed on 66 patients with exophoria, 55 of whom obtained satisfactory results from a military standpoint. In exophoria the relative amounts of divergence excess and convergence insufficiency were found of little importance in determining the most desirable type of operation. Recession of the lateral rectus was preferred and performed on 35 patients. Eighty-three operations were performed on 51 patients with esophoria, 47 of whom obtained satisfactory results. Resection of the external rectus was most frequently performed because of divergence insufficiency. Twenty-seven operations were performed on 18 patients with hyperphoria, 15 of whom obtained satisfactory results. In eight of these, paresis of the superior rectus existed in one eye with overaction of the inferior oblique of the other eye. In these myectomy of the overacting inferior oblique was performed. Plain catgut no. 4-0 was preferred to chromic catgut of the same caliber because the latter failed to become absorbed in several eyes.

Chas. A. Bahn.

Vancea, P. Sulfa therapy in trachoma. *Ann. d'Ocul.*, 1941, v. 177, no. 8, pp. 300-312.

Fifty cases of trachoma were observed during five months and are reported statistically. All patients were

given sulfathiazole internally. The average dose was 100 grams. The patients were divided into five groups. Those in the first group were given only sulfathiazole internally, in the second sulfathiazole internally and a 5-percent sulfathiazole ointment locally, in the third only sulfathiazole ointment, in the fourth sulfathiazole by rectum, and in the fifth sulfathiazole ointment followed by conjunctival massage. In 20 of the patients slight bodily symptoms were observed from the internal use of the sulfathiazole. The author concludes that sulfa therapy is the most practical and rapid treatment for trachoma. The virus of trachoma was not found after four or five weeks.

Chas. A. Bahn.

3

PHYSIOLOGIC OPTICS, REFRACTION, AND COLOR VISION

Bane, W. M. **An analysis of the changes in refraction (based on a study of the case histories of Dr. Edward Jackson).** Trans. Amer. Ophth. Soc., 1944, v. 42, pp. 399-410.

The author reviewed the records of 10,000 of Dr. Edward Jackson's patients who had repeated refractions for 10 years or longer. In hyperopic errors of refraction he found a marked tendency toward an increase in the spherical and cylindrical components. In myopic errors there was a slight tendency toward a decrease in the spherical component, with an increase in the cylindrical component. There was a marked tendency to an increase of the total myopia until the age of 40 years; after that age the trend was toward an increase in the hyperopia. In mixed astigmatism the trend was toward a decrease in the amount of astigmatism. (10 tables, bibliography.)

Carl D. F. Jensen.

Bannon, R. E. and Walsh, R. **Repeatability of keratometric readings.** Amer. Jour. Ophth., 1946, v. 29, Jan., pp. 76-85.

Berry, G. L. **Visual discomfort in eye workers due to glasses.** Jour. Oklahoma State Med. Assoc., 1945, v. 38, Sept., p. 361.

The author presents a plea for more accurate testing of the functions of the extraocular muscles and of accommodative power in routine refraction. He believes that properly placed prisms or decentered lenses should be used in many more spectacles. Numerous examples are given. Morris Kaplan.

Diaz-Caneja, Emilio. **Bicylindrical correction.** Arch. de la Soc. Oft. Hisp.-Amer., 1945, v. 5, Jan., pp. 19-23.

The author discusses the biastigmatism of Marquez and affirms its accuracy. He states, however, that the method is complicated and requires reference to tables, which is inconvenient. He prefers a more direct method of refraction, using a frontofocometer.

J. Wesley McKinney.

Dejean, C., and Roux, N. **Bilateral contracture of accommodation by abuse of sulfonamides.** Bull. Soc. d'Ophth. de Paris, 1939, Oct.-Dec., pp. 582-584. (See Section 2, Therapeutics and operations.)

Fink, W. H. **Trial frame for young children.** Trans. Amer. Ophth. Soc., 1944, v. 42, pp. 397-398. (See Amer. Jour. Ophth., 1945, v. 28, p. 403.)

Goldmann, H. **Objective determination of visual acuity.** Ophthalmologica, 1943, v. 105, May, pp. 240-252.

A new method is offered for the objective determination of visual acuity

in malingerers. The test object consists of a plate which swings behind a window-shaped opening in a screen. The plate is covered by a coarse checkerboard pattern whereas the screen is a checkerboard which consists of much smaller squares. To an eye which cannot distinguish the squares in the coarse pattern, the plate and screen appear as a uniform gray surface and the swinging movement behind the window opening is not noticed. If the coarse pattern is perceived, its swinging motion will be noted and the eye will follow these oscillatory movements involuntarily. Max Hirschfelder.

Linneu Silva and Correa, C. A. *Transitory myopia from sulfanilamides*. Rev. Brasileira de Oft., 1945, v. 4, Sept., pp. 5-26.

After reviewing a number of cases from the literature, the authors record a personal case, with the usual history of rapid recovery after withdrawal of the drug. During the attack the patient's myopic error increased in the maximum meridian from 0.5 to 3.5D. (Bibliography.) W. H. Crisp.

Marquez, M. *Bi-astigmatism*. Ann. d'Ocul., 1941, v. 177, no. 11, pp. 415-425.

The derivation of the formula for the computation of spherocylindric equivalents of two cylinders at oblique axes is given. Illustrative cases are mentioned to show the potential advantages of obliquely crossed cylinders.

Chas. A. Bahn.

McFarland, R., Halperin, M., and Niven, J. *Visual thresholds as an index of the modification of the effects of anoxia by glucose*. Amer. Jour. Physiol., 1945, v. 144, Aug. 1, p. 378.

The measurement of differential in-

tensity thresholds for vision at low levels of brightness provides a sensitive and objective index of the impairment caused by anoxia. This test was applied to the study of the modification of this impairment by glucose. Three fasting subjects were used at simulated altitudes of 12,700 to 17,200 feet.

The ingestion of 50 grams of glucose during exposure to low oxygen tensions (simulated high altitude) resulted in a considerable decrease in the impairment due to anoxia. At a simulated altitude of 13,800 feet, the administration of glucose diminished the visual impairment of one subject to an amount corresponding to an altitude of only 8,000 feet. The "physiological altitude" was thus 42 percent lower than the actual altitude. In the other two subjects the lowering of the physiologic altitude was 25 percent and 48 percent, respectively.

The ingestion of glucose one-half hour before exposure to low oxygen tensions likewise prevented a large part of the impairment expected from anoxia.

Control experiments, in which a saccharin solution was given at simulated high altitude instead of glucose, showed no effects on the impairment caused by anoxia.

The administration of glucose to fasting subjects at a normal atmospheric oxygen tension resulted in no improvement of visual sensitivity. An improvement occurred only if visual sensitivity had first been impaired by anoxia.

The amount of improvement of visual sensitivity during anoxia after glucose administration, in relation to time, was approximately parallel to the blood-sugar curve during its rise and subsequent fall.

The increase in carbon-dioxide production after glucose ingestion lags behind the rise in blood sugar and declines considerably later than the fall in blood sugar. The "anti-anoxic" effect of glucose, therefore, seems to depend directly on the blood-sugar level rather than on the secondary increase in carbon-dioxide production.

Theodore M. Shapira.

Porter, A., and Godding, E. W. Dark-adaptation studies in skin disease. *Brit. Med. Jour.*, 1945, June 16, p. 840.

Dark adaptation was tested in 103 patients with nonparasitic skin diseases and in 101 normal controls. There was no significant difference between the two groups. One patient with pityriasis rubra pilaris had normal dark-adaptation after vitamin A therapy.

Francis M. Crage.

Woods, A. C. Myopia therapy by visual training. *Amer. Jour. Ophth.*, 1946, v. 29, Jan., pp. 28-57.

4

OCULAR MOVEMENTS

Redslob, E., and Delbos, R. Superior oblique paresis of sinus origin. *Ann. d'Ocul.*, 1941, v. 172, no. 10, pp. 371-378.

A man, 30 years of age, suddenly developed a crossed diplopia. The vertical separation of images was greatest in the lower left quadrant and the image of the right eye was the lower. After radiograms of the sinuses had been taken the patient was placed on appropriate treatment, the details of which are not mentioned. Immediately recovery followed. The causation and pathology are discussed at some length.

Chas. A. Bahn.

5

CONJUNCTIVA

Bhalerao, C. K. Trachoma. *Antiseptic*, 1945, v. 42, Sept., p. 491.

A short general discussion of trachoma is presented for the general practitioner of India. The author prefers the use of silver nitrate and copper sulfate and believes that sulfonamides have no therapeutic effect on the disease itself.

Morris Kaplan.

Guerry, Du Pont, III. Oculoglandular tularemia. *Virginia Med. Monthly*, 1945, July, p. 295.

Ocular tularemia in a child of 7 years is described. It closely resembled vaccinal conjunctivitis when first seen, but when severe systemic reactions developed, routine agglutinations revealed the true diagnosis. The differential diagnosis is discussed.

Morris Kaplan.

Kahaner, J. R. Exogenous meningococcic conjunctivitis. *New York State Jour. Med.*, 1945, v. 45, Aug. 1, p. 1687.

This case of exogenous meningococcic ophthalmia is presented in order to stress the need for complete cultural and serologic differentiation of the species of *Neisseria* which may be responsible for a suppurative conjunctivitis. A diagnosis of gonorrheal ophthalmia based only on the clinical characteristics of the lesion and the presence and the laboratory report of gram-negative intracellular and extracellular diplococci in a smear may be erroneous.

Theodore M. Shapira.

Morax, P., and Costil, L. Keratoconjunctivitis, phlyctenular and tuberculous infections. *Ann. d'Ocul.*, 1941, v. 177, no. 12, pp. 435-446.

Thirty patients were studied in de-

tail. In eight, the morning gastric content with swallowed expectoration was found to contain tubercle bacilli as proved by staining and positive guinea-pig inoculation. Ages ranged between 2 years and 20. In one third of the cases tuberculosis was present in the immediate family or in contacts. A tuberculous skin reaction was positive in all. Of 13 patients examined radiologically, 10 had evidence of old thoracic lesions. Of the 30 patients, 19 were female and 11 male. The authors conclude that phlyctenular disease should not be treated as a purely local condition. Search should be made among the immediate family or contacts for tuberculosis, and some of the patients should be managed according to a modification of the regime designed for the tuberculous.

Chas. A. Bahn.

Reid, J. J., and Anigstein, L. **Keratoconjunctivitis in cattle on the Gulf Coast of Texas.** Texas Reports on Biol. and Med., 1945, v. 3, Summer, p. 187.

Infectious keratoconjunctivitis of North American cattle is endemic and frequently becomes epidemic. Fifty to 70 percent of herds may become infected, which causes much economic waste. The symptoms are similar to those of the disease in man though the disease is more severe in cattle and much oftener leads to complete opacification of the cornea. It is highly contagious. Laboratory studies revealed a hemolytic diplobacillus as the specific etiologic agent. The disease is most probably a systemic infection which confers immunity. Prevention by means of a specific bacterial vaccine is being investigated.

Morris Kaplan.

plantation. Canadian Med. Assoc. Jour., 1945, v. 53, Dec., p. 548.

The author describes a corneal transplantation combined with cataract extraction after which the patient's visual acuity was 1/60. He calls attention to the value of the operation for sight saving and urges the establishment of an eye bank.

Morris Kaplan.

Friede, R. **The need for a protective knife in penetrating keratoplasty.** Klin. M. f. Augenh., 1942, v. 108, Sept.-Oct., p. 570.

Friede believes that the insertion of a metal or ivory spatula into the anterior chamber during penetrating keratoplasty is not only unnecessary but dangerous. If it seems necessary to protect the deeper structures of the eye, it is wiser to use small circular plates, adapted exactly to the size of the corneal hole, which can be inserted in it temporarily. The upper part of the plate contains four small holes and four notches intended to receive sutures to keep it firmly in place. The upper edge overhangs the plate itself to prevent it from falling into the anterior chamber. It can be left in place for hours or even days in cases where the donor's flap has been lost or a new flap is not available immediately. (3 figures.)

F. Nelson.

Halbertsma, K. T. A. **Papilloma of the cornea.** Ophthalmologica, 1943, v. 105, June, pp. 299-307.

The author describes a case of papilloma of the cornea of fifty years' duration. The condition is rare, and only 100 cases have been previously reported. It is very difficult to differentiate clinically, and sometimes even histologically, between papilloma and epithelioma. The pathologic differences are discussed in the article.

Max Hirschfelder.

Kronenberg, B. Multiple tuberculous nodules of the episclera. *Amer. Jour. Ophth.*, 1946, v. 29, Jan., pp. 86-88.

Magitot, A. Mooren's ulcer of the cornea treated by Moretti's suture. *Bull. Soc. d'Ophth. de Paris*, 1939, Oct.-Dec., pp. 574-575.

A typical case of Mooren's corneal ulcer is described. After various forms of therapy had failed, the author applied a silk suture around the cornea as suggested by Moretti. Starting on the temporal side, the needle is directed under the conjunctiva 2 to 3 mm. from the limbus and both suture ends are finally brought back on the cheek. The result in this instance was excellent, with early cicatrization and healing of the ulcer.

Morton R. Cholst.

7

UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Blegvad, Olaf. Iridocyclitis and disease of the joints in children. *Acta Ophth.*, 1941, v. 19, pts. 3-4, pp. 219-236.

The author reports six cases of this syndrome and reviews five which have been reported. The disease attacks children from two to ten years of age. The joint disease may be a chronic juvenile infectious peri-arthritis or have all the symptoms of Still's disease, with recurrent febrile periods, progressive polyarthritis, polyadenitis, anemia, enlargement of the spleen, and muscular atrophy. The eye and joint symptoms are usually of equal severity. The iridocyclitis has no distinctive features. When the illness is mild good vision is recovered but often a band-shaped keratitis remains. Severe inflammations may end in occlusion of the pupil, iris bombé, complicated cataract, and blindness. Of the author's six patients four

recovered with good vision. One had 3/18 vision in one eye, and one had 2/36 in the right eye and 6/24 in the left. (References.) Ray K. Daily.

Brueckner, R. Eye and cholinesterase (first report). *Ophthalmologica*, 1943, v. 105, Jan., pp. 37-49.

To investigate the importance of acetylcholine and similar substances in the chemical reactions that are associated with the transmission of nervous impulses, Brueckner studied the presence of cholinesterase in the eye. This substance is a ferment which inhibits the effect of acetylcholine. The fluids of the eyeball as well as tissue extracts can be tested for the presence of cholinesterase by bringing them in contact with acetylcholine *in vitro*. Cholinesterase splits acetylcholine into choline and acetic acid. The latter liberates carbon dioxide from a solution of sodium bicarbonate. The quantity of carbon dioxide that is liberated can be measured manometrically and is an index of the quantity of the esterase. Using this method on eyes of cattle and horses the author found that cholinesterase is always present in the aqueous humor. Its concentration relative to the total proteins is greater in the aqueous than in the blood serum; therefore he assumes that some of it comes from other sources than the blood. The cholinesterase content of the vitreous in the eyes of cattle and swine is very considerably higher than that of the aqueous. The concentration varies in different parts of the vitreous. It is probable that the esterase in the vitreous has its origin in the retina. Physostigmine inhibits the action of the ferment. (Literature.)

Max Hirschfelder.

Brueckner, R. Eye and cholinester-

ase (second report). *Ophthalmologica*, 1943, v. 106, Oct., pp. 200-212.

The presence and quantity of cholinesterase in different parts of the uveal tract of the eyes of cows were determined by the manometric method described by the author in a previous report. The greatest quantity of cholinesterase was found in the pupillary part of the iris; the pigment epithelium of the iris and the retina contained about half as much. Decreasing amounts were found in the intermediate and ciliary part of the iris and in the equator of the choroid. Still less was found elsewhere in the choroid, the base of the ciliary body, and, especially, the pigment epithelium of the retina. These findings show that cholinesterase is increased in the sites where acetylcholine is formed. This is also true for the intraocular muscles which are innervated by the oculomotor nerve.

Max Hirschfelder.

Delord, Emile. **A new syndrome: recurrent iritis, vitreous hemorrhages, recurrent ulcers of the mouth and of the genital organs.** *Ann. d'Ocul.*, 1941, v. 172, no. 10, pp. 366-371.

A man 55 years of age had this syndrome for four years, with an ultimate visual acuity of 4/10 in the right eye and 2/10 in the left eye. The possibilities of syphilis, tuberculosis, focal infection with staphylococcus, and allergy are discussed and dismissed. Five somewhat similar cases in the literature are briefly reviewed.

Chas. A. Bahn.

Esbjerg, H. O. **A case of uveoparotid fever attended by erythema nodosum and pulmonary changes.** *Acta Ophth.*, 1941, v. 19, pts. 3-4, pp. 286-292.

A case of typical uveoparotid fever associated with erythema nodosum and

sarcoid of Boeck in the lungs in a woman 25 years of age is reported. The disease began with joint manifestation and cutaneous eruptions; two weeks later the patient developed bilateral swelling of the parotid glands; a peripheral paresis of the left side of the face appeared in two days, and a month later she was found to have a bilateral iridocyclitis. Roentgenographic studies of the lungs suggested Boeck's sarcoid. The tuberculin test was negative. The author reviews the investigations on the etiology of uveoparotid fever, and concludes that it is a manifestation of the sarcoid of Boeck. (References.)

Ray K. Daily.

Foss, Bjorn. **Bilateral recurrent hypopyon-uveitis (Behcet's syndrome).** *Acta Ophth.*, 1941, v. 19, pts. 3-4, pp. 292-329.

A review of the literature reveals that this disease predominantly attacks men 5 to 40 years of age, and in all but one of the patients was accompanied by diseases of the skin or oral mucous membrane. In more recent publications bilateral recurrent hypopyon-uveitis is reported as a part of Behcet's trisymptomatic syndrome, associated with a general cutaneous hypersensitivity, especially to staphylococcus vaccine. The etiology is unknown; it may be tuberculosis, focal infection, an endocrine disturbance, avitaminosis, or a virus infection. It is not known whether the eye lesion is secondary to a primary disease of the skin and mucous membrane or whether there is simultaneous involvement of the other tissues and of the eye by an unknown virus. The hypopyon-uveitis leads to total blindness within a few years. No fatalities are on record; neither is there a cure.

Two cases are reported in detail. One occurred in a seaman, 30 years of age, who had recurrent acute attacks of blurred vision with hypopyon; the hypopyon cleared up rapidly, but the vitreous did not clear between the attacks. Vision failed gradually, and a relative scotoma and macular changes developed early; later, the fields became contracted concentrically, and the optic papilla became atrophic, with thin partially obliterated vessels. Late in the disease the attacks of uveitis were associated with ulcers of the mouth, and finally ulcers on the genitalia appeared. All forms of therapy were futile, and the patient became blind. The second patient was a man of 35 years, who developed chills, fever, malaise, a purulent eruption on the legs, and foggy vision a few days after he had waded through a stream. Since then he has had repeated attacks of fever, pain in the muscles and joints, ulcers and abscesses of the skin, and ulcers in the mouth and scrotum. Vision became blurred a few days after the onset of each attack. Within two years his visual acuity was reduced to the ability to count fingers at one meter from the eyes. During the next two years the patient had 10 attacks of hypopyon-uveitis in each eye. At the end of this time the right eye was soft and shrunken and had an opaque lens. The left eye was soft but the fundus was visible; the optic disc was atrophic, and the vessels thin and partially obliterated. In the course of the disease, fleeting nodules which resembled pustules appeared on the iris and left small holes therein. This patient was hypersensitive to staphylococcus vaccine; minute subcutaneous doses caused enormous infiltrations followed by attacks of uveitis. In the course of therapy, blood transfusions, while powerless to halt

the progress of the disease, produced immediate improvement and some clearing of the media. (References.)

Ray K. Daily.

Manschot, W. A. **Expulsive hemorrhage. Two remarkable anatomic discoveries.** *Acta Ophth.*, 1941, v. 19, pts. 3-4, pp. 237-253.

Two cases of expulsive hemorrhage after cataract extraction are reported. The histopathologic examination of the enucleated eyes revealed unusual data which might have escaped discovery but for the examination of serial sections. In the first case, the hemorrhage occurred immediately after the precipitous delivery of the lens as soon as its capsule was opened. The microscopic sections revealed the presence of an angioma racemosum around a vortex vein. The author believes this to be the first case of this form of intraocular angioma to be reported.

The expulsive hemorrhage in the second patient occurred on the second day after an uneventful extraction. The microscopic sections revealed an extensive necrosis of the walls of some ciliary arteries with thrombosis of a considerable area. In addition there were necrotic choroidal vessels which could have produced the hemorrhage. There was evidence of chronic glaucomatous change in the anterior uveal tissue, which suggests that glaucoma might have been the cause of the necrosis of the ciliary arteries. (15 photomicrographs, references.)

Ray K. Daily.

McGregor, I. S. **Segmental movement of the pupil.** *Brit. Med. Jour.*, 1945, May 5, p. 629.

This motion takes the form of a twitch of the sphincter or pupillary margin of the iris. The twitch may in-

volve one part of the margin and then another, or there may be synchronous twitches in separate parts of the sphincter, called concertinalike movement. Twitching in the latter form is much less common than are single, partial, or double synchronous forms. This sign may be seen in eyes which have no pupillary response to light. It has been observed in luetic optic atrophy, quinine amblyopia, posttraumatic sphincter paralysis, and in Leber's disease. A monocular loupe or low-power microscope suffices for recognition in most cases. The condition which the author calls pupillary unrest may occur whenever there is a sufficiently severe disturbance of the afferent or efferent nerve paths to the iris sphincter. Peripherally acting mydriatics which inhibit the choline flux can produce it. Weakness of conduction in the nerve path and variability in the amount of the impulse which reaches the sphincter help to explain the trouble. The sign has no localizing value.

Francis M. Crage.

Schalig, G. A. Koyangi's disease with report of one case of unilateral uveitis, herpetic keratitis, dysacusis, alopecia, poliosis, and vertigo. *Klin. M. f. Augenh.*, 1942, Sept.-Oct., v. 108, p. 584.

Koyangi's disease is a very rare symptom complex of unknown etiology. The author's patient was a man, aged 47 years, whose left eye became almost blind within four days as a result of acute anterior uveitis and keratitis. A spotty depigmentation of the hair of the scalp, eyebrows, and lashes as well as of the skin of the head and part of the neck was observed. There was also a partial loss of hair in these regions and an almost complete loss of the beard. This process had started

about one year previously and was accompanied by a complete loss of libido. Tinnitus and vertigo began two weeks before the first examination. The left ear became deaf at the same time the left eye became blind. Serologic, neurologic and otologic examinations were essentially negative. Within two weeks the patient's condition improved. The left eye became almost normal. The hair began to grow and regained its pigment. The sexual functions became normal. There were three recurrences in the 12 years after the first attack; each attack was followed by almost complete recovery. In this case the left eye alone was involved in each attack, whereas both eyes are usually affected. The essential manifestations of the 39 reported cases of Koyangi's disease are presented in tabular form. (Bibliography.)

F. Nelson.

8

GLAUCOMA AND OCULAR TENSION

Bloomfield, Sylvan. Parasympathomimetic effect of aqueous humor in human eyes with and without chronic simple glaucoma. *Proc. Soc. Exper. Biol. and Med.*, 1945, v. 60, Nov., p. 293.

Aqueous humor was withdrawn from eyes which had been exposed to eserine and strong light. Seven eyes had chronic simple glaucoma and 10 had no glaucoma. These fluids were perfused through isolated hearts of frogs. The aqueous humor from normal eyes induced reactions exactly similar to those of acetylcholine whereas the glaucomatous fluid did not. Apparently a parasympathomimetic substance is present in normal eyes but is absent from eyes with chronic glaucoma.

Morris Kaplan.

Cramer, F. K. Cyclodiathermy as an antiglaucomatous operation. - *Ophth.*

Ibero Amer., 1945, v. 6, no. 4, pp. 349-373 (in Spanish), and pp. 374-385 (in English).

The author made a series of experiments on rabbits as to the action of Vogt's method of penetrating cyclodiathermy and also of the flat method of cyclodiathermy used by Weve and by Albaugh and Dunphy.

Cramer concludes that the hypotensive effect of diathermy is practically the same for both techniques. He favors flat cauterization as being less traumatizing.

The hypotensive effect appeared to vary more with the intensity of the cauterization than with the extent of the surface cauterized. Cauterization of one fourth of the circumference was adequate to produce hypotension. Changes in the ciliary body varied according to intensity and extent of cauterization. Changes in the transparent media were not experienced, so that the proceeding could be employed not only in hemorrhagic and absolute glaucoma but also in other clinical forms. (9 figures, 4 photomicrographs, references.)

W. H. Crisp.

Gradle, H. S. A glaucoma clinic. Ophth. Ibero Amer., 1945, v. 7, no. 1, pp. 1-5 (in Spanish), and pp. 5-9 (in English).

The author describes the working of the glaucoma clinic which is attached to the Illinois Eye and Ear Infirmary. The management of the clinic is in the hands of an ophthalmologist and a full-time resident, with the assistance of a stenographer. The Social Service of the clinic is made responsible for seeing that the patient returns to the Infirmary at proper intervals for examination. A study of the visual fields of patients who have been under treatment more than two years indicates that 70

percent of those with normal visual fields have suffered no loss whatever, 16 percent show some change, and 14 percent have lost visual fields completely. About 147 per thousand of the patients remain industrially blind. The clinic now has on record about 1,760 cases, this number being increased by 20 to 30 each month. The living conditions of the patients are studied by the Social Service, and improved as far as possible. Glaucoma is the cause of 15 to 20 percent of all the cases of blindness in the United States. Ten years ago, an analysis of the cases of glaucoma seen at the Illinois Eye and Ear Infirmary in previous years showed that these patients stayed under observation less than two years and were never seen again.

W. H. Crisp.

Radnot, Magda. The anterior lobe of the hypophysis and the intraocular pressure. Ophthalmologica, 1943, v. 106, Oct., pp. 182-188.

The author found that the extract of the anterior lobe of the pituitary gland reduces the intraocular pressure. Large and small doses have the same effect. In three patients who were given the extract for dystrophia adiposo-genitalis a similar effect was noted. In animals which were subjected to unilateral sympathectomy a hypotension after injection with the hormone was of shorter duration on the sympathectomized side; whereas the hypotension lasted longer in the other eye than in normal animals. Sympathectomy alone had no effect on the intraocular pressure.

Max Hirschfelder.

Redslob, E. Glaucoma without hypertension and glaucomatous excavation. Ann. d'Ocul., 1941, v. 177, no. 9, pp. 323-340.

Structurally eyes vary greatly in

their reaction to intraocular pressure. A woman 62 years of age, whose visual acuity in the right eye and left eye was 20/50 and 20/40, respectively, and who has a 3D. overhanging excavation of the disc of the left eye was observed for eight months. At no time did the intraocular pressure exceed 20 mm. Hg in either eye irrespective of the use of mydriatics. The excavation of the disc was attributed to cavernous degenerative changes in the optic nerve in and behind the disc which diminish the resistance of the lamina cribrosa to tension. This may be associated with slight inflammatory reactions. The visual fields were essentially those of glaucoma. (31 references.)

Chas. A. Bahn.

Vidal, F., and Malbran, J. L. **Stelectomy and neurovegetative drugs.** *Ophth. Ibero Amer.*, 1944, v. 6, no. 3, pp. 257-270.

Ephedrine sulfate, 5 percent, does not affect intraocular pressure after stelectomy, causes less mydriasis after stelectomy, has equal action whether the stelectomy is recent or old. Adrenalin does not change the tension, and is only active after old stelectomies. Benzedrine sulfate, 0.25 percent, in normal and stelectomized eyes, causes less mydriasis after stelectomy.

W. H. Crisp.

Zeeman, W. P. C. **Two cases of secondary glaucoma with histologic findings.** *Ophthalmologica*, 1943, v. 106, Sept., pp. 136-142.

Hyperature cataracts led to acute inflammatory glaucoma in two patients. The enucleated eyes showed an edema of the optic nerve head and many swollen cells in the chamber angle, the spaces of Fontana, and in the iris tissue. Typical inflammatory infiltrations were lacking. The author interprets the

findings as signs of an abacterial inflammation of toxic origin due to deterioration of the lens substance. (References.)

Max Hirschfelder.

9

CRYSTALLINE LENS

Altmann, F., and Dingmann, A. **Congenital deafness and cataract following rubella in the mother.** *Arch. of Otolaryng.*, 1945, v. 42, July, p. 51.

A case of congenital deafness and cataract in a child whose mother had had rubella during pregnancy is described.

According to Swan and his co-workers, all children of mothers who have rubella during the first two months of pregnancy are congenitally defective, and one half of the children will be defective if the disease is acquired during the third month of pregnancy. If the disease occurs after the third month congenital defects occur only occasionally.

Rubella is a serious disease during early pregnancy and gives rise to many practical problems. Erickson makes the following suggestions: girls should not be allowed to pass through childhood without having contracted rubella—a deliberate exposure at an opportune time would be deemed wise; rubella convalescent serum should be given to all women who are in the early stages of pregnancy and have not had rubella, particularly after exposure or during an epidemic; the justification for therapeutic abortion if rubella occurs during the first two months of pregnancy should be debated.

Theodore M. Shapira.

Cibis, P. **Cataract in neurodermitis disseminata.** *Klin. M. f. Augenh.*, 1942, v. 108, May-June, p. 281.

Neurodermitis is a dermatosis and is also variously termed eczema num-

mulare, eczema en plaques, dermatitis lichenoides pruriens. It is characterized by chronic recurrent paroxysmal pruritis, thickening of the skin, and coarseness of the skin folds. It may be limited to small areas or be widespread. Exacerbations during fall and winter occur. This skin disease is often accompanied by juvenile cataract in the form of a disc-shaped opacity at the anterior pole of the lens. It has been assumed that disturbances of internal secretion are responsible for the development of this skin disease as well as of the cataracts. The skin symptoms can sometimes be relieved by thyroid medication, but the cataract does not regress. Heredity seems to play an important part.

The report of two cases: (1) In a female of 39 years the dermatosis started after bronchitis when she was four or five weeks old. Cataracts developed at the age of 32 years and one of them was extracted successfully. Adequate clinical and laboratory studies revealed the absence of disturbances of metabolism and endocrine functions. (2) A male of 44 years suffered from "chronic eczema" since he was ten. Neurodermatosis had been diagnosed previously. A cataract in the right eye was diagnosed at the age of 36 years and was removed surgically one year later, but a dense pupillary membrane and secondary glaucoma developed. The glaucoma was controlled by miotics. In the left eye a subcapsular cataract in the posterior cortex was extracted extracapsularly. Here also glaucoma followed, necessitating cyclodialysis and miotics. There was no evidence of disturbed metabolism. (5 photographs, bibliography.)

F. Nelson.

Dunnington, J. H., Locatcher-Khorazo, D. Value of cultures before operation for cataract. *Arch. of Ophth.*, 1945, v. 34, Sept., pp. 215-219.

A study of a series of 2,508 cataract extractions was made to determine the value of preoperative cultures in the prognosis of postoperative infections and the influence of chemotherapy.

For the past eight years cultures of the eyes of patients admitted for cataract extraction have been examined for their bacterial flora. The purpose of this study was to determine whether any particular microorganisms were responsible for postoperative infections. More recently these bacteriologic studies have been extended to aid in the evaluation of preoperative prophylactic chemotherapy.

A detailed table is given of the various organisms found. *Staphylococcus albus* was encountered in 1,705 cases; pathogenic *Staphylococcus aureus* in 529 cases, which was defined by the fermentation of mannitol and the production of coagulase.

The authors' conclusions are that postoperative infections were due in the great majority of cases to pathogenic *Staphylococcus aureus*.

Postoperative infections observed were independent of the type of operation.

Of 730 cases in which no preoperative cultures were made and the preoperative treatment consisted of the instillation of 25-percent solution of protein silver three or four times in the twenty-four hours preceding operation, postoperative infection occurred in 13.

In 663 cases in which penicillin ointment (1,000 to 2,000 Oxford units), or sodium sulfathiazole ointment, 5 percent, was used preoperatively, no infections occurred.

In 104 cases in which, because of known pathogenic organisms, operation was delayed until treatment with penicillin or sulfathiazole had been applied, no infections occurred.

This study indicates that preopera-

tive cultures should be made on admission in every case in which cataract extraction is to be done, with a view to prophylactic treatment.

R. W. Danielson.

Duverger, C., and Bregeat, P. **Cataract and chronic glaucoma.** Arch. d'Opht., 1945, v. 5, no. 1, p. 3. (See Section 8, Glaucoma and ocular tension.)

Kötz, H. **A statistical study of hemorrhage after operations for senile cataracts.** Klin. M. f. Augenh., 1942, v. 108, May-June, p. 291. (See Section 2, Therapeutics and operations.)

Lindner, K. **Cataract operations, old and new methods.** Klin. M. f. Augenh., 1942, v. 108, Sept.-Oct., p. 567.

Lindner briefly summarizes the development of cataract surgery during the last four decades. He advocates routine subconjunctival injection of a small amount of a 3-percent cocaine solution around the cornea, which produces a complete and persistent anesthesia and mydriasis. He uses a retrobulbar injection of novocaine. Instead of one peripheral iridectomy he makes two, one on each side of a suture which he applies before he makes the incision with the cataract knife. Lindner prefers the sliding maneuver to the tumbling of the lens because the latter leads to more frequent vitreous prolapse. He irrigates the anterior chamber with warm Ringer's solution. When the lens capsule is very tense he pricks it and allows some cortex to escape so that the capsule may be grasped more easily with the forceps. F. Nelson.

McGraw, James L. **Marfan's syndrome with unusual complications.** Arch. of Ophth., 1945, v. 34, Aug., pp.

112-113. (See Section 17, Systemic diseases and parasites.)

Papolczy, F. **Changes in cataract operation with round pupil.** Klin. M. f. Augenh., 1942, v. 108, Sept.-Oct., p. 567.

To avoid incarceration or prolapse of the iris caused by rupture of the wound, corneoscleral suturing is important in extractions with round pupil. The author prefers Imre's method, which he has modified slightly. After a bridge suture has been placed in the tendon of the superior rectus muscle, a silk suture is inserted through the conjunctiva into the episcleral tissue, 2½ mm. above the limbus. Section is made with a Graefe knife, as usual, with formation of a conjunctival flap, except that the latter is cautiously withdrawn from the wound before the incision is completed. The bulbar conjunctiva is cut with a pair of curved scissors and dissected from the episcleral tissue to form a semilunar flap. After severance of the small corneoscleral bridge, the flap is put back on the cornea. Papolczy performs peripheral iridectomy and extracts the lens intracapsularly. The suture is knotted three times and left in place for 10 days. F. Nelson.

Rados, A. **Vitamin C saturation and senile cataract.** Arch. of Ophth., 1945, v. 34, Sept., pp. 202-209.

Investigators are unanimous in the opinion that the amount of vitamin C present in the lens and in the aqueous is much higher than in other tissues or in the blood. However, there is a wide discrepancy in the explanations of how this high concentration of vitamin C is produced. Vitamin C diminishes as the lens becomes progressively opaque and disappears when the opacification is complete.

The lens, being devoid of a blood supply, is especially dependent for its normal metabolism on intracellular substances which form oxidation-reduction systems.

The important observation that the vitamin-C content of the normal lens diminishes in proportion to the formation of cataract to values approaching zero and, also, that aging of the lens similarly results in decrease of the vitamin-C content, seems to substantiate the belief that vitamin C is of extreme importance for the respiration of lens tissue.

Vogt, on the other hand, doubts that hypovitaminosis C is the cause of cataract. He believes that senile cataract develops irretrievably and inevitably from the genetic anlage.

The author says, however, that one of the most common misconceptions of genetic laws seems to be the conclusion that a character which is conditioned by heredity cannot be modified by environment. Hence, even if the concept of the hereditary basis of senile cataract were to be accepted, it would not exclude the possibility of environmental influences, of which metabolism, directly or indirectly (as vitamin C influencing the adrenal cortex), is only one of the numerous factors.

After discussing the literature and his experiments, Rados concludes that the saturation test is the most accurate index of vitamin-C deficiency. Of 200 unselected patients with cataract, 135 revealed a saturation level of the body for vitamin C.

The remainder of the series, 65 patients, showed a low level of vitamin-C excretion after intravenous administration of ascorbic acid. In 35 patients the deficiency was mild, and in 33 patients it was so pronounced as to represent a general deficiency.

There is not sufficient evidence to indicate that vitamin-C deficiency contributes to the formation of cataract. The vitamin-C deficiency of some of the cataractous patients seems to be the natural result of the vitamin-C deficiency of old age. R. W. Danielson.

Torres Estrada, Antonio. Some modifications in suture and technique of the cataract operation. *Bol. del Hosp. Oft. de Nuestra Señora de la Luz*, 1945, v. 3, May-Aug., pp. 50-67.

The author reviews and illustrates a number of sutures, including one which he describes as that of Suarez de Mendoza but which seems to have a good deal of resemblance to a suture known in the United States as that of McLean. The 18-page article, with its 18 illustrations, restates the author's complete technique for cataract extraction.

W. H. Crisp.

Weber, H. Thermic circulation in the lens. *Klin. M. f. Augenh.*, 1942, v. 108, Jan.-Feb., p. 99.

The vertical convection current in the anterior chamber is a well-known normal phenomenon which is caused by the difference of the temperature in the anterior and posterior parts of the chamber. Weber reports the case of a male of 45 years in whose right eye an extracapsular-cataract extraction had been followed by the development of a dense secondary membrane which gradually transformed into a sac shaped like the original lens and filled with fluid and cortical detritus. With increasing clarification of the fluid a definite slow thermic circulation was observed which gradually became more rapid so that eventually the current flowed as fast as that in the anterior chamber. An attempt to extract the lenticular sac in toto was unsuccessful.

ful. The capsule ruptured and some milky fluid escaped, some vitreous prolapsed. Vision became 5/5. (References.) F. Nelson.

10

RETINA AND VITREOUS

Adrogué, E., and Tosi, B. **Disciform degeneration of the macula.** Arch. de Oft. de Buenos Aires, 1943, v. 18, Aug., p. 385.

A case of bilateral disciform degeneration of the macula of the senile type is reported. The literature on the subject is briefly discussed. (4 illustrations, bibliography.) Plinio Montalván.

Benavides, E. S. **A contribution to the biomicroscopy of the normal vitreous.** Arch. de la Soc. Hisp.-Amer., 1944, v. 4, Nov.-Dec., p. 1082.

The conclusions based on an examination of 300 normal eyes are: (1) The vitreous is a colloid in the form of a hydrogel with a density which increases from the center to the periphery and a structure which is as varied as fingerprints. The appearance of the vitreous may be fibrillar, cellular, or tufted. A loose fibrillar structure is characteristic of colloidal maturity and is more frequent in the second half of life. (2) The arrangement in light and dark bands, which is seen with the biomicroscope, is an illusion due to the illumination and direction of observation modified by the refracting ocular media. There are no vacant areas in the vitreous and no bands which rise and fall. (3) The retrolental space does not exist, and the surface of the vitreous is in intimate contact with the posterior surface of the lens. (4) Normally Cloquet's canal is not visible biomicroscopically, and Ida Mann's theory relative to this structure is not supported

by mathematical calculation of its size. (5) The arciform line of Vogt is actually the external limit of an undulating circular surface, probably related to Cloquet's canal in fetal life. The embryonal remains of the hyaloid artery originate at some point on this surface.

(6) The changes which the vitreous undergoes with the years affect its luminosity, so that there is a difference between juvenile, adult, and senile vitreous. Generally the luminosity depends on the quantity of uveal pigment, which is more luminous in blue than in dark eyes. It becomes less luminous with age and since luminosity diminishes with the acidity of a colloid, this decreasing luminosity indicates an increasing acidity. (7) It is necessary to revise the index of refraction of the vitreous. The reasons for such diseases as myopia, glaucoma, and retinal detachment should be sought in these colloidal transformations. (Numerous illustrations.) Ray K. Daily.

Borley, W. E., McAlester, A. W. III, and Lower, R. A. **Central macular chorioretinitis in Naval personnel.** U. S. Naval Med. Bull., 1945, v. 45, Sept., p. 511.

Laboratory studies were made on a group of 31 young adult males who had central macular areas of chorioretinitis. A typical case is described. All ordinary and routine laboratory tests were negative. Spinal fluid from the patients was injected into the eyes, brains, and peritoneal cavities of guinea pigs. Control injections were also made with normal spinal fluid. The brain and peritoneal injections were essentially negative whereas all the eye injections produced pathologic lesions. The affected eyes became the site of acute iridocyclitis which appeared within a day and

remained active for two to three weeks; the lenses became opaque and the vitreous humor became cloudy. In the control animals no eye symptoms developed. These results suggest a possible involvement of the cranial nerves.

Morris Kaplan.

Broendstrup, Poul. **Retinal detachment as a hereditary disease.** *Acta Ophth.*, 1941, v. 19, pts. 3-4, pp. 272-280.

A review of the literature is followed by a report of the author's own material. The history of one family reveals three cases of retinal detachment in three successive generations, at the age of 50, 19, and 10 years, respectively, and probably a fourth case in an earlier generation. In a second family one of two sisters had a retinal detachment in her myopic right eye at the age of 14 years, and the other, who was emmetropic, in the left eye at the age of 25 years. In the third family a brother and a sister with congenital ocular anomalies developed retinal detachment: the sister at the age of 13 years after an injury, and the brother at the age of 15 years.

The author concludes that retinal detachment can be an inherited disease and that no significance can be attributed to axial myopia. Infantile and senile retinal detachments occur predominantly in nonmyopic eyes and retinal detachments in myopic eyes occur in the intermediate years. Myopia predisposes to retinal detachment because the pathologic changes that are conducive to retinal detachment occur with greater frequency and at an earlier age in the myopic than in other people. Inherited myopia and degeneration are produced by two adjacent genes which are not always associated. If, in my-

opia, the second gene is absent, no retinal detachment need occur regardless of the degree of myopia. Trauma is not as significant a factor as it is assumed to be. It is astounding to observe the severe traumatism which myopic eyes tolerate without developing retinal detachment. It is doubtful if detachment should be attributed to a trauma in eyes in which there is no external evidence of injury. (References.)

Ray K. Daily.

Godfrey, E. W., Schenck, H. P., and Silcox, L. E. **Response of the retina to the direct roentgen beam.** *Radiology*, 1945, v. 44, March, pp. 229-236.

The writers used the method of Pirie for determining the extent of retinal damage and the possible presence of opaque foreign bodies in 74 eyes injured in battle. The findings in 52 of them are tabulated. The authors were able to predict an intact retina in nine patients in whom ophthalmoscopic observation was impossible, and in 15 instances a diagnosis of retinal destruction was made. They discuss the sensitivity of the retina to Xrays and believe that the phenomenon may be valuable in assessing the condition of the retina. Occasionally an intraocular foreign body may be detected by the patient when the X-ray beam traverses its site to reach the intact retina. (Bibliography.) Melchior Lombardo.

Heath, P., and Zuelzer, W. W. **Toxoplasmosis (report of eye findings in infant twins).** *Trans. Amer. Ophth. Soc.*, 1944, v. 42, pp. 119-130.

The authors describe two premature infants with toxoplasmosis. There is a description of pathologic preparations of the eye of the deceased infant as well as of the ophthalmoscopic findings in

the surviving identical twin. The chorioretinal lesion in the acute stage was a slightly elevated, yellowish-white, well-demarcated lesion. The old healed lesions simulate coloboma. The mother and surviving twin reacted positively when the blood serum was tested for neutralizing antibodies of toxoplasma. (5 photomicrographs, bibliography.)
Carl D. F. Jensen.

Longhena, Luisa. The retroretinal fluid in retinal detachment. *Ophthalmologica*, 1943, v. 106, July-Aug., pp. 27-40 and 80-92.

After reviewing the literature dealing with the physio-chemical composition of the retroretinal fluid in retinal detachments, the author adds her own investigations based on the study of 30 cases. The color, reaction, transparency, refractive index, protein content, albumin-globulin relation, chloride content, and sugar content were determined. She concludes that the retroretinal fluid is primarily an exudate which in the earlier stages is diluted by the influx of vitreous. In older detachments the fluid has a higher protein content due to disintegration of the retinal cells. Longhena stresses the fact that the retroretinal fluid has a different composition from that of the vitreous and therefore cannot be identified with it. The theory of the inflammatory origin of retinal detachment is strengthened by the exudative character of the retroretinal fluid. The chemical analysis of this fluid can give clues as to the functional integrity of the detached retina and can, therefore, be of prognostic value.

Max Hirschfelder.

O'Donoghue, W. D. Retinal vascular sclerosis. *Irish Jour. of Med. Science*, 1945, July, p. 214.

The author describes the ophthalmoscopic picture of retinal vessels in many diseases. True retinopathy begins when necrosis first occurs in the smallest terminal branches of the arterial tree. Then similar changes in the arterioles of vital organs have already passed their acme. Once these retinopathic changes are seen, the patient rarely lives more than two years.

Francis M. Crage.

Pischel, D. K. Diathermy operation for retinal detachment: comparative results of different types of electrodes. *Trans. Amer. Ophth. Soc.*, 1944, v. 42, pp. 543-567.

The author has attempted to determine and demonstrate the most efficient type of electrode for the surgery of detached retina. He briefly reviews the methods used since Gonin described his procedure in 1919. Experimental work is presented and 20 excellent photomicrographs demonstrate the difference in the retinal, choroidal, and scleral changes which result from the use of the large electrodes of Weve and Lindner and of the author's fine penetrating and perforating electrodes. Ignipuncture causes the scleral canal to become filled with a plug composed of episcleral tissue. For this reason ignipuncture is superior to surface coagulation. It gives a maximum choroidal and retinal reaction with a minimal scleral necrosis.

Carl D. F. Jensen.

Rønne, Henning. The ontogenesis of the course of the macular fibers. *Acta Ophth.*, 1941, v. 19, pts. 3-4, pp. 199-201.

Rønne rejects the theories of Vossius and Ida Mann on this subject and attributes the structure of the paramacular fibers and the median raphe to a

passive centrifugal displacement of the nerve-fiber layer by the development of the fovea, which occurs considerably later. Action of a centrifugal movement in the inner layers of the retina is indicated also by the oblique course of the fibers in Henle's layer and in the transitory layer of Chievitz. Support for this theory is found also in the diminishing distance between the macula and optic papilla in the latest months of fetal life. Since the external nerve-fiber layer develops long before the fovea, it can be assumed that the growth of the macula forces the nerve fibers into a curved course, and in doing so they mechanically draw the macula towards the papilla. The radial course of the nerve fibers beyond the macula and in the nasal portion of the retina is their primary course, which, in the paramacular region, is altered by the development of the fovea. The arrangement of the fiber layer in a logarithmic spiral with the radius of curvature almost proportional to the foveal distance could result from a centrifugal force originating in the fovea. (References.) Ray K. Daily.

Shannon, C. E. G., Jaeger, R., and Forster, F. M. **The combined intracranial and orbital operation for bilateral retinoblastoma.** Trans. Amer. Ophth. Soc., 1944, v. 42, pp. 326-331.

The authors present a case of bilateral glioma. The tumors were removed by the combined intracranial and bilateral extirpation recommended by Jean. A frontal craniotomy is performed, and the optic nerves are severed behind the optic foramina. Two weeks later, the eye and the remaining portion of the optic nerve are removed. (3 photographs, 4 photomicrographs, bibliography.) Carl D. F. Jensen.

11

OPTIC NERVE AND TOXIC AMBLYOPIAS

Jensen, V. A. **A persistent Bergmeister papilla.** Acta Ophth., 1941, v. 19, pts. 3-4, pp. 267-271.

A case of this unusual congenital anomaly is reported. The papilla of the right eye was concealed under a bluish-white, shining, smooth, sharply outlined mass of tissue, from which fine offshoots extended peripherally to become inserted into a greyish-red, horse-shoe-shaped, circumpapillary retinal ridge which opened nasally and upward. The inner surface of the ridge ascended sharply, whereas the outer surface descended gradually toward the remainder of the eyeground. The macular and foveal reflexes were absent. The blood vessels were probably cilioretinal, since there were no traces of the hyaloid artery. This anomaly is explained by an arrest in the absorption of the Bergmeister papilla; the remaining prepapillary neuroglial tissue interferes with the development of the retina and is pulled forward as a circumpapillary ridge. (1 drawing, references.) Ray K. Daily.

13

EYEBALL AND ORBIT

Caillaud, M., and Fournie, F. **A case of tuberculous gumma of the eye.** Ann. d'Ocul., 1941, v. 172, no. 10, pp. 379-384.

A woman, 24 years of age, developed a painful swelling in the left lower temporal part of the sclera of the left eye. There was a swelling four d.d. in diameter in the temporal part of the fundus. She had had grippe followed by hemoptysis and pleurisy. The eye recovered in four months with only slight scarring. Chas. A. Bahn.

Serpa, José. Duane syndrome. *Rev. Brasileira de Oft.*, 1945, v. 4, Sept., pp. 43-45.

The symptoms presented, in a white Brazilian aged 20 years, were left enophthalmos, diminution of the palpebral fissure, slight internal strabismus, and torticollis. W. H. Crisp.

Zonder, H., and Ticho, A. So-called thyrotropic exophthalmos. *Brit. Med. Jour.*, 1945, June 16, p. 836.

Until a few years ago exophthalmos was thought to occur with Graves's disease only. Clinical and experimental studies have shown that aside from the thyrotoxic form there must be another, attributable to the thyrotropic factor of the anterior pituitary lobe. This form is named thyrotropic exophthalmos. The latter affects males predominantly and is rather uncommon. The exophthalmos is brought about by changes in the ocular muscles. In the thyrotoxic form there are three possible factors; namely, sympathetic stimulation of Mueller's muscle, adynamia of the rectus muscles, and anatomic changes in the muscle fibers, such as wasting, loss of striation, and fibrillation. In the thyrotropic form the proptosis is brought about by a muscle disorder that is characterized by diffuse extensive fibrosis, edema, marked round-cell infiltration, and a special type of fibrotic-muscle change, with disintegration and absorption. In the thyrotropic type there is greater proptosis as well as epiphora, photophobia, diplopia, and convergence difficulty, whereas in the thyrotoxic type patients are free from these symptoms, except in malignant thyrotoxicosis.

Three cases of thyrotropic exophthalmos are presented. In two there were marked decalcification of the

skull and sellar enlargement. Diabetic glucose-tolerance tests were made, and all patients responded favorably to diiodotyrosine. Two patients were given pituitary irradiation.

Francis M. Crage.

14

EYELIDS AND LACRIMAL APPARATUS

Amendola, Francisco. The lacrimal gland in ocular leprosy. *Rev. Brasileira de Leprologia*, v. 13, no. 1 (in *Arquivos Brasileiros de Oft.*, 1945, v. 8, June, p. 93.)

The author found that extirpation of the lacrimal gland produced a considerable improvement in the ocular condition of patients with leprosy. He concludes that the lacrimal gland is a focus of infection in ocular leprosy.

W. H. Crisp.

Broendstrup, Poul. Lateral dislocation of the medial canthus. *Acta Ophth.*, 1941, v. 19, pts. 3-4, pp. 281-285.

A case of this rare congenital and inherited deformity is reported. The eyes of this five-year-old girl were normal in other respects. The inner canthi were misplaced laterally, covering the caruncle and shortening the palpebral fissure horizontally. Medially the sclera was invisible, the nasal edge of the cornea was covered, and at the inner angle the lids came together without forming the lacrimal lake. The lacrimal puncta were placed more temporally than is usually seen. The caruncle, hidden behind the lids, was flat and small and closer to the lower lid than normal. The eyebrows were longer than usual, and the fine hair on the cheeks and forehead were very prominent. The pathogenesis of this anomaly has not been determined. Van der

Hoeve attributes it to an excessively long anlage for the lacrimal canal; the caruncle becomes too large and exerts an irritating effect on the inner commissure, which reacts by growing laterally and covering the caruncle. Waardenburg considers the deformity an arrested stage in the embryonic development that is reached in the third month of fetal life. (photograph, references.) Ray K. Daily.

Filatov, V. The tubular stem in ophthalmology (translation by D. V. Giri). Indian Jour. Ophth., 1945, v. 6, July, pp. 23-31; and Oct., pp. 43-50.

This is an English translation, in an Indian journal, of a paper by the Russian Filatov, but without indication of its previous journal origin. It deals with many varieties of skin flap used in plastic surgery. W. H. Crisp.

Muskatblit, E., and Targen, N. A. Ringworm of the eyebrow. Arch. Dermat. and Syph., 1945, v. 52, Aug., p. 116.

Ringworm of the eyebrow is rare. The case reported demonstrates the importance of examination by means of filtered ultraviolet rays, which show infection of hairs by *Microsporon* when ordinary light fails to reveal any lesion of the hairs or skin.

It is also suggested that during examination for ringworm the Wood light be directed not only toward the patient's scalp but toward the face. If this is done systematically, it is possible that ringworm of the eyebrows will be found to be more common than is supposed. Theodore M. Shapira.

Rapin, M. Restoration of the upper and lower lid. Ophthalmologica, 1943, v. 105, May, pp. 233-239.

After discussing the standard meth-

ods of plastic repair of the upper and lower lid, the author describes his own method which he used to repair extensive damage caused by lupus vulgaris. He restores the upper lid in two stages. First he lines a flap from the skin of the forehead with mucous membrane. In the second stage he grafts the flap into the proper position.

Max Hirschfelder.

Thiel, R. Reconstructive surgery of the lacrimal passages. Klin. M. f. Augenh., 1942, v. 108, Sept.-Oct., p. 576.

Thiel describes a method for the surgical reconstruction of the lacrimal canal which has lost its patency. His method is essentially a modification of the procedure of Nižetić. In place of the wax mandrel Thiel uses a conical style molded of elastic polyviol. He forms a new duct by covering the style with mucous membrane from the lip. The grafted mucous membrane that envelops the style is fixed around it with sutures before it is inserted in the wound bed. This tubule is sutured into the opening in the tear sac as well as to the conjunctiva. The style is left in position for eight days. It is advisable to fill the new-formed canaliculus with oil or an ointment every other day after the removal of the style. Only the lower duct is restored. (11 illustrations.) F. Nelson.

15

TUMORS

Biró, I. A case of metastatic orbital carcinoma with enophthalmos. Acta. Ophth., 1941, v. 19, pts. 3-4, pp. 255-260.

Biró reports an unusual case of metastatic orbital carcinoma in which there was an initial 3-mm. enophthalmos. The woman, 41 years of age, had both breasts removed within a year be-

cause of malignant tumors. She complained of diplopia and ptosis of the right upper lid of two weeks' duration. There was restriction of motion up and out and a feeling of resistance in the orbit. She was given X-ray therapy without success. (Photographs, references.)
Ray K. Daily.

Buerki, E. Retothel sarcoma of the orbit. *Ophthalmologica*, 1943, v. 105, May, pp. 253-267.

Retothel sarcoma is a neoplasm which is almost unknown in ophthalmologic literature. The tumor is also known as Ewing's sarcoma. Though there is still some question about its cytogenesis, it is probable that it is reticuloendothelial in origin.

The clinical and pathologic manifestations in a case of generalized retothel sarcomatosis, which at first appeared as an orbital tumor, are described. The author cites the four known cases of retothel sarcoma in the ophthalmic literature and believes that many of the round-cell sarcomas of the orbit previously described may be retothel sarcoma. Lymphosarcomas which arise from lymphoblasts and lymphocytes have to be distinguished from retothel sarcoma. (References.)

Max Hirschfelder.

Pascheff, C. Investigations of hemoblastic growths in the orbit and local eosinophilia in chloroma. *Klin. M. f. Augenh.*, 1942, v. 108, Sept.-Oct., p. 529.

Of the diseases of the hemopoietic organs which Sternberg names hemoblastoses, lymphoma, myeloma, and chloromata occur in the orbit. Lymphoma belongs to the group of primary aleukemic hyperblastic processes of the lymphatic system. Pascheff reports two cases, one in a man of 70 years and one in a boy of three. The

diagnosis was verified by puncture biopsy. X-ray treatment cured both completely. Myeloma in the orbit is very rare. It is a malignant tumor unaccompanied by hematologic changes. Two cases of orbital chloroma were found among 500,000 patients seen during a period of 42 years. Chloroma develops in the periosteum, usually in the upper rim, causing a typical exophthalmos. Its presence is noted in one orbit, but eventually both sides are involved. Of diagnostic importance is a leukemic or subleukemic blood picture, with large undifferentiated cells that are also found in the tumor itself. The green color of the tumor is not always manifest. It usually occurs in young children between the second and seventh year of life. Radium treatment is of no avail. Of Pascheff's patients, one died three weeks and one three months after admission. Postmortem examination of one of these revealed metastases in the lymph nodes of the neck, thorax, and abdomen. All abdominal lymphatic organs as well as the liver and the kidneys, the cranial bones, and ribs were invaded by the tumor. In the other patient, the tumor was found in both orbits, in the occipital bone, one rib, all vertebrae, and in dura of the cerebellum. There was anemia of all the organs and parenchymatous degeneration of the myocardium, liver, and kidneys. The bone marrow was reddish green. There were eosinophilic myelocytes in the tumor. (10 photographs, references.)

F. Nelson.

Paulo, A., Jr. Primary malignant melanoma of the optic disc. *Rev. Brasileira de Oft.*, 1945, v. 4, Sept., pp. 29-41.

The patient was a married white woman aged 50 years. For three years

the vision of the right eye had been progressively cloudy. The papillary origin of the tumor was indicated by the fact that the papillary portion of the tumor was much more considerably developed than the choroidal expansion, and that the connective-tissue network of the lamina cribrosa was displaced forward. The tumor was highly pigmented. (7 illustrations, references.)

W. H. Crisp.

Szabo, G., and Cseh, E. *Neurinoma of the sclera near the limbus*. *Ophthalmologica*, 1943, v. 106, July, pp. 14-25.

The authors describe a tumor as large as a hazelnut in the upper outer quadrant of the right eye of a boy 12 years of age. Histologic examination showed a typical neurinoma. The tumor was adherent to the sclera, but not to the conjunctiva. These tumors are rare and develop from nerve loops situated near the limbus. No other similar tumors, such as neurofibromas or warts, were found in the patient. The authors review the literature concerning neurinomas in different parts of the eye. (Bibliography.)

Max Hirschfelder.

16

INJURIES

Anderson, O. C. *Traumatic blood cyst of the orbit*. *Klin. M. f. Augenh.*, 1942, v. 108, Sept.-Oct., p. 547.

A case of orbital blood cyst is reported. The patient, a man aged 44 years, had been hit by a hammer in the region of the left eyebrow. A short wound was sutured but during the next three days a large swelling necessitated the removal of the stitches. While this was being done, a small purulent hematoma escaped from the wound. Two years later the first symp-

toms of tumor formation in the orbit were observed. X-ray studies revealed cloudiness in the upper half of the orbit. Because a retrobulbar tumor was suspected, a surgical operation was suggested but denied by the patient. Two years later the exophthalmos had increased, and the vision of the left eye was now 5/15. Numerous horizontal retinal folds were visible at the posterior pole. Orbitotomy revealed an ochre-yellow, brittle substance and remnants of brownish red blood in a cystic sac. The orbital periosteum was destroyed in some places, and the pressure of the cyst had produced a small depression in the bone behind the upper orbital rim. Surgery is the only possible treatment, but total removal of the wall of the cyst is probably not imperative because the structure consists of connective tissue and is not lined by epithelial cells. F. Nelson.

Carvalho Pinto, W., and Mendonça de Barros, J. *Intraocular foreign body and bulbar siderosis*. *Arquivos Brasileiros de Oft.*, 1945, v. 8, June, pp. 71-74.

A stoneworker, aged 42 years, had a completely opaque left crystalline lens, with a slightly greenish tint and small deposits of a rusty color on the anterior capsule. The pupil was partially dilated. Most of the corneal parenchyma showed pigmentation. The outlines of the iris were blurred, the stroma was slightly atrophic, and some areas were depigmented.

Pain being elicited by the approach of an electromagnet to the eye, an incision was made in the sclera, and the magnet promptly withdrew a dark metallic fragment measuring 2.5 by 0.5 mm. The patient subsequently recalled that about a year and a half earlier, in striking a chisel with a mallet, the left eye had been hit by a

fragment, the blow causing him temporarily to lose his senses. (1 color plate.) W. H. Crisp.

Kjerrumgaard, Erling. A case of ocular chalcosis. *Acta Ophth.*, 1941, v. 19, pts. 3-4, pp. 261-266.

A boy, 14 years of age was hurt by the explosion of a cartridge, as a result of which numerous particles of copper from the cartridge case penetrated both orbits and the right eyeball. Subsequently both eyes developed sunflower cataracts, and the fragment of copper in the right eye became visible as a dark body in the fundus, covered with organized tissue. The point to be stressed is the relatively good prognosis of chalcosis. In this case vision in the two eyes was 6/6 and 6/9, four years after the injury. (2 color photographs, references.) Ray K. Daily.

Krimsky, Emanuel. Extensive knife wound of the orbit with complete recovery. *The Eye, Ear, Nose and Throat Monthly*, 1943, v. 22, Feb., pp. 58-60.

A Negro, 37 years old, was wounded in the head by a butcher knife. There was proptosis of left eyeball with profuse hemorrhage from the wound, and the point of the knife could be seen on the posterior pharyngeal wall. X-ray studies revealed the presence of the blade of the knife, which was 9 inches long and about 3½ inches wide. It had entered near the outer wall of the left orbit and extended almost vertically downward for about 5 inches. The blade, which was firmly imbedded in the skull, was removed, and the patient made an uneventful recovery. The vision was normal, and the muscle functions not disturbed. (2 figures.)

Melchiore Lombardo.

Lieux and Saint-Martin, R. Injury of the trigeminal nerve by retroöbital

shell splinter. *Ophthalmologica*, 1943, v. 105, Jan., pp. 1-12.

In a patient who had been injured by a large shell splinter which had penetrated the orbit to the Gasserian ganglion, the ophthalmic nerve, the upper branch of the maxillary nerve, and the cheekbone were severed. Complete paralysis in the field of these two nerves and loss of the deep sensitivity were noted. However, there was no neuromyolytic keratitis nor any alteration of the retinal arterial pressure nor of the ocular tension. (Bibliography.)

Max Hirschfelder.

McGrigor, D. B., and Samuel, E. War wounds of the orbit and eyeball. *Brit. Jour. Radiology*, 1945, v. 18, Sept., p. 284.

A short review of methods of the radiology of intraocular foreign bodies is presented as part of a symposium on radiology of war injuries. Only 50 percent of intraocular foreign bodies were demonstrable by radiographic examination. The Sweet method of localization and an anterior-posterior projection method were preferred. Observations on the more frequent fractures of the orbital wall are discussed.

Morris Kaplan.

Ostow, M. The frequency of blinking in mental illness. *Jour. Nervous and Mental Dis.*, 1945, v. 102, Sept., p. 294.

Blinking recurs at a centrally regulated rate, which is fairly constant in the individual. In this respect it resembles the respiratory rhythm, although it is not so regular. Blinking increases in states of excitement, increased attention, surprise, cogitation, drowsiness and yawning, and in the prehypnotic state. Increased movement of the eyeball, concentrated study, and

interest in objects decrease the rate of blinking.

Patients, with functional mental disease blinked less uniformly and more rapidly than normal individuals and those who have recovered from a recent functional disturbance of the nervous system. The rate of blinking does not vary in a regular relationship with other subjective or objective manifestations of nervous disease. Its frequency seems to vary directly with the individual's interest in his environment and inversely with the clarity of his comprehension of it.

The authors tentatively assume that the center of blinking is in the pallidohypothalamic tract.

Francis M. Crage.

Saint-Martin, R. *Bitemporal hemianopsia due to injury*. *Ophthalmologica*, 1943, v. 105, June, pp. 289-298.

A fracture of the left frontal bone was followed by bitemporal hemianopsia. There was total optic atrophy in the right eye, and atrophy of the nasal side of the optic nerve in the left eye. The sense of smell was lost. The author assumes that the hemianopsia is due either to a tear in the chiasm or to microscopic rents in the midportion of this structure. Max Hirschfelder.

Velhagen. *Rare histologic findings in an eye injured by wood*. *Klin. M. f. Augenh.*, 1942, v. 108, Sept.-Oct., p. 553.

The left eye of a man, aged 74 years, had been injured by a wooden splinter which the patient had removed with his fingers. Six months later the eye had to be enucleated because of danger of sympathetic ophthalmia. Histologic examination revealed chronic uveitis, traumatic cataract, hyalitis, anterior synechia, and an oval structure at the site of the corneal perforation. The

cells composing this structure were hexagonal. Some of them contained minute granules; some, indistinctly stained clouds; and others, nuclei varying in number and shape. Some were round, some elongated, and some were horseshoe shaped; all were distinctly stained with hematoxylin. The cell membranes were doubly refracting. The whole formation was encapsulated in a membrane containing giant cells with pigment granules, epithelioid cells, and round cells. Two botanists affirmed that the structure was composed of plant cells but that the nuclei found in the inner cells were not derived from plants. They were either the nuclei of human giant cells or of leucocytes. Small vegetable foreign bodies can be partly or completely absorbed by human cells, not only in the orbit but also in the interior of the globe. (1 microscopic drawing, 1 photomicrograph, references.) F. Nelson.

Wiser, H. J. *Eye injuries in war casualties aboard a hospital ship*. *United States Naval Med. Bull.*, 1946, v. 46, Jan., p. 67.

Ocular injuries were present in 8 percent of all casualties brought aboard. Treatment, though at times extensive, was actually an interim treatment before final removal to a fixed hospital. Severe lacerations and multiple foreign bodies were present in most of the eyes. The gratifying results are ascribed to the very generous use of penicillin which was given by injection, in ointment, and by instillation. It was also used for irrigation in solutions which contained 2,000 units per cubic centimeter. Morris Kaplan.

gland in ocular leprosy. *Rev. Brasileira de Leprologia*, v. 13, no. 1 (in *Arquivos Brasileiros de Oft.* 1945, v. 8, June, p. 93.) (See Section 14, Eyelids and lacrimal apparatus.)

Bischler, Vera. **Malformations of the eye and of the heart.** *Ophthalmologica*, 1943, v. 106, Oct., pp. 169-181.

The author found reports of only 14 cases of coincidental malformation of the eye and the heart, and adds four observations of her own. In two patients there was a coloboma of the uveal tract, and in two the lens was abnormal. Three of the patients had so-called Roger's heart disease, the fourth had a probable perforation of the cardiac septum. (Bibliography.)

Max Hirschfelder.

Clark, C. P. **Albinism with co-existing anomalies of the central nervous system.** *Trans. Amer. Ophth. Soc.*, 1944, v. 42, pp. 250-261.

Clark presents an interesting review of albinism. Pigment in animal tissue results from the union of a chromogen and an enzyme which activates the chromogen. Where either of these is absent there is no pigment. Lack of pigment in tissue is known as albinism and is a hereditary genetic defect. Waardenburg recognizes seven types of albinism on the basis of the degree of pigment paucity, the tissues which are involved, and the pattern according to which the defect is inherited. Clark describes seven patients. The first patient exemplified a case of total universal albinism (Waardenburg's Type 1), the others incomplete universal albinism (Type 2). (2 figures, bibliography.)

Carl D. F. Jensen.

Dame, L. R. **Eye and ear sequelae of scrub typhus fever.** *Bull. U. S. Army*

Med. Department, 1945, v. 4, Nov., p. 554.

One half of fifty patients who were convalescing from scrub typhus fever had some transient ocular and aural symptoms. No diminution of vision nor of hearing was found, however there were moderate enlargement of the blind spot and contraction of visual fields in most of the patients, and occasionally a scotoma was found. Moderate derangement of the vestibular system after caloric stimulation occurred.

Morris Kaplan.

Frandsen, H., and Lundh, B. **Riboflavin and arboflavinosis with special reference to eye changes.** *Acta Ophth.* 1941, v. 19, pts. 3-4, pp. 331-345.

A brief review of the literature is followed by a detailed report of the author's own studies of 104 patients with an average age of 75 years. Seventy-five patients had symptoms of ariboflavinosis, which consisted of superficial vascularizing keratitis, cheilitis, abnormal redness of the moist prolabium, redness and atrophy of the mucous membrane of the tongue, stomatitis, dysphagia, skin changes on the face and extremities, and nail changes. Ocular symptoms were found in 48 of the 75 patients; the subjective symptoms were photophobia, fogged vision, smarting and itching of the eyes, asthenopia, and dull vision. The objective symptoms were conjunctivitis with conjunctival and slight ciliary injection, and vascular development in the limbus, and arcus senilis as far as 3 mm. into the cornea. The intramuscular administration of 5-10 mg. of riboflavin daily affected a cure in 70 percent of 47 patients treated; the average treatment period was 24 days, and the total riboflavin intake was 216 mg. Three of 13 patients with no evidence

of riboflavin deficiency, treated for several months with large quantities of nicotinic acid, developed photophobia and corneal vascularization. These changes promptly disappeared under riboflavin treatment. There is a close connection between the effect of riboflavin and nicotinic acid; in people with low vitamin-B reserve, symptoms of ariboflavinosis may be produced by intensive nicotinic-acid therapy. The best therapeutic results were derived from intramuscular administration. (Bibliography.) Ray K. Daily.

Rodriguez, B., Rodriguez Barrios, R., and Oreggia, A. A new type of peduncular syndrome. Internuclear ophthalmoplegia and bilateral cerebellar syndrome from a tegmental lesion. Arch. Uruguayos de Med., etc., 1945, v. 27, Oct., pp. 353-370.

The authors' patient, a woman of 62 years, had a vascular syndrome of the mesencephalon. The softening occurred in the peduncular tegmentum. The clinical picture, of sudden onset, included paralysis of associated ocular movements (internuclear anterior ophthalmoplegia) and a bilateral cerebellar syndrome. An initial hemiplegia rapidly recovered. Various signs disclosed involvement of the posterior longitudinal bundle. The authors regard the case as representing a new mesencephalic syndrome which they propose to name "oculocerebellar syndrome from tegmental lesion." (11 figures, references.) W. H. Crisp.

18

HYGIENE, SOCIOLOGY, EDUCATION,
AND HISTORY

Charlin Correa, Carlos. Arch. Chilenos de Oft., 1945, v. 2, Sept.-Oct.

This 53-page issue is entirely devoted to addresses and memorials de-

livered on the occasion of the funeral of this dean of Chilean ophthalmologists. Carlos Charlin Correa was born in Santiago de Chili in April, 1885. He studied in France, Switzerland, and Italy, published in 1924 a treatise on clinical ophthalmology, and was particularly known for his description of the syndrome of the nasal nerve which has been a good deal associated with his name. (Bibliography, portrait.)

W. H. Crisp.

Farias, Natalicio de. Prevention of blindness. Arquivos Brasileiros de Oft., 1945, v. 8, April, pp. 41-46; also Rev. Brasileira de Oft., 1945, v. 4, Sept., pp. 47-53.

This is a report presented to the second Pan-American Congress of Ophthalmology, Montevideo, November, 1945, under the following headings: organization for the prevention of blindness, official and governmental (National League for the Prevention of Blindness and Santa Luzia Foundation); and suggestions presented by the author to the Congress. The author suggests that the struggle against blindness needs to be more individual than governmental in character, responsibility resting largely upon physicians, dentists, pharmacists, opticians, nurses, and midwives. He desires to see published in the United States of America a review in Portuguese, Spanish, and English, on the progress of ophthalmology and related subjects, and to be distributed gratuitously.

W. H. Crisp.

Farmer, E. Occupational adjustment of the blind. The Lancet, 1945, Oct. 13, p. 474.

The author, an industrial psychologist, divides the blind into three groups: those who are blinded since

infancy and have no visual memories; those blinded by illness; those blinded by trauma. Most persons in the last group are civilian or military war casualties. He insists that the blind have only their blindness in common and differ in other respects like all people. Intelligence tests are being devised which will be entirely unlike those used for normal individuals. These should determine the capacity of the individual to adapt himself to his blindness and to a vocation. It is shown that the commonly held belief that the nonvisual senses are better developed among the blind than among the sighted is erroneous. Touch, for instance, is often inferior among the blind because the skin of the finger tips is thickened from constant use. More care should be given to developing vocational tests for the blind because it takes longer to prepare for a vocation, and disappointment in case of failure is apt to be greater.

Morris Kaplan.

Garden, R. R. *Child health*: 15. *The blind child*. *The Practitioner*, 1945, v. 155, Sept., p. 180.

In England between the years 1919 to 1943 the number of people who are blind from infancy was reduced by one half. This is ascribed largely to the control of gonorrheal ophthalmia. The first system of education for the blind occurred in France in 1784, and was followed in England in 1791. The au-

thor insists that blind children under the school age of five years should be kept at home for normal infant training and with strict avoidance of overprotection and pampering. When they are five years old these children should be placed in schools for the blind, which is compulsory in England. Elementary and secondary education should differ little from the education for the sighted. Morris Kaplan.

Gradle, H. S. *The development of an ophthalmologist*. *Ophth. Ibero Amer.*, 1945, v. 7, no. 2, pp. 95-100 (in Spanish), and pp. 100-105 (in English).

The author briefly outlines an adequate course of study for the profession of ophthalmology, giving the number of hours he considers should be assigned to each of 16 sections of the subject during a preliminary course of study, and in another tabulation an outline of the clinical division of the student's training. W. H. Crisp.

Queiroga, G. *Teaching of ophthalmology in the United States*. *Arquivos Brasileiros de Oft.*, 1945, v. 8, June, pp. 75-85.

The author recounts his experiences as an auxiliary resident in the Eye Clinic of the University of Iowa from October, 1943, to December, 1944. He inserts a number of details drawn from the University catalogue.

W. H. Crisp.

NEWS ITEMS

Edited by DR. DONALD J. LYLE
904 Carew Tower, Cincinnati 2

News items should reach the editor by the twelfth of the month

DEATHS

Dr. Sullivan L. Andrews, Lewiston, Maine, died November 26, 1945, aged 68 years.

Dr. Robert H. Butler, Bellefontaine, Ohio, died November 21, 1945, aged 64 years.

Dr. Walter S. Franklin, Santa Barbara, California, died January 2, 1946, aged 67 years.

Dr. James P. Goray, Fitchburg, Massachusetts, died November 12, 1945, aged 78 years.

Dr. John R. Harrison, Greer, South Carolina, died November 22, 1945, aged 53 years.

Dr. Spencer S. Howe, Bellingham, Washington, died November 8, 1945, aged 69 years.

Dr. John L. Keane, Dubuque, Iowa, died November 3, 1945, aged 49 years.

Dr. Charles S. Marsden, San Diego, California, died October 13, 1945, aged 72 years.

Dr. George A. Moore, Palmer, Massachusetts, died October 6, 1945, aged 74 years.

Dr. Edgar L. Morrill, Fort Collins, Colorado, died January 19, 1946, aged 69 years.

Mr. Max Poser, Rochester, New York, died January 4, 1946, aged 75 years.

MISCELLANEOUS

The Annual Congress of the Ophthalmological Society of Egypt took place at the Memorial Laboratory, Giza, Egypt, on March 15-16, 1946. The symposium of the Congress was on "Tuberculous manifestations in the eye."

A tri-session conference of civilian doctors and Army Medical Corps officers, specializing in ophthalmology and related plastic surgery, was held recently at Valley Forge General Hospital, Phoenixville, Pennsylvania.

Lt. Col. Elliott Randolph (MC), Chief Consultant in Ophthalmology to the Surgeon General, and Dr. James N. Greear, Jr., former Chief of the Valley Forge General Hospital Eye, Ear, Nose, and Throat Section, were among the guests present at the meeting.

A total of 70 ophthalmologic cases were examined and discussed during the conference, which was opened with a discussion on "Military plastic surgery," by Lt. Col. Bradford Cannon (MC), Chief of the Valley Forge General Hospital Plastic Surgery Section. Lt. Col. Phillips Thygeson (MC), Chief of the Eye, Ear, Nose, and Throat Section, presided.

The following civilian ophthalmologists were among those attending: Drs. P. Robb McDonald, Alan Crandall, Francis H. Adler, Walter I. Lillie, Irving H. Leopold, Harold Scheie, and Joseph Waldman.

The book publishing firm of W. W. Norton and Company announce that they are again inviting manuscripts for submission to be considered for the Norton Medical Award of \$3,500.00 offered to encourage the writing of books on medicine and the medical profession for the layman. Closing date for submission of manuscripts this year is November 1, 1946. All particulars relating to requirements and terms may be had by addressing W. W. Norton and Company, Inc., 70 Fifth Avenue, New York 11, New York.

SOCIETIES

At the meeting of the Milwaukee Ophthalmic Society, held on February 26th, the following program was presented: "Ocular leprosy" by Dr. George Dunker; "The stability of penicillin in ophthalmic solutions" by Dr. E. Grossman; "Problems of facial reconstruction" by Dr. B. P. Churchill; and "The fundus of scrub-typhus" by Dr. John Hitz.

A combined meeting of the Philadelphia Roentgen Ray Society and the Section on Ophthalmology of the College of Physicians of Philadelphia was held on January 17, 1946. Dr. Carlos Santos, professor of radiology, Lisbon, presented a paper on "Physiologic and technical fundamentals of stereoscopic fluoroscopy especially adapted for the removal of foreign bodies."

The Brooklyn Ophthalmological Society held its regular meeting on February 21st. A demonstration of the Berman metal locator was made by Samuel Berman. Dr. Walter V. Moore, Col. (MC), spoke on "At home and overseas." Dr. Mortimer Lasky presented a paper on "Eye pathology from the Bulge and Siegfried Line."

At the meeting of the Buffalo Ophthalmologic Club, which was held on February 14th, Dr. John H. Dunnington presented a paper on "The present status of penicillin in ophthalmology." Following this an informal round-table discussion on "Ocular surgical problems" was held.

At the second clinical conference of the Chicago Medical Society, held from March 5th to 8th, Dr. Peter C. Kronfeld spoke on "Eye conditions that should be recognized by general practitioners."

The Reading Eye, Ear, Nose, and Throat Society of Reading, Pennsylvania, held its fifty-first meeting on January 16, 1946, at the University of Pennsylvania. Dr. Francis Heed Adler conducted the program for the Eye Section, which included the following papers: "Chemotherapy in ophthalmology" by Dr. Irving H. Leopold, "Penetrating wounds" by Dr. Shay, and "Artificial tears" by Dr. Lamott.

PERSONALS

Dr. William B. Clark, professor of ophthal-

mology, Tulane University, Louisiana School of Medicine, has just returned to New Orleans from a three weeks' visit to Guatemala and Mexico, where he is continuing his research project on the ocular manifestations of onchocerciasis.

Dr. Claude S. Perry, Columbus, has been named acting chairman of the department of ophthalmology, Ohio State University College of Medicine, Columbus, Ohio, with the rank of associate professor.

BOWEN'S DISEASE OF THE CONJUNCTIVA*

V. R. KHANOLKAR, M.D.

Bombay, India

Bowen¹ in 1912 described a chronic condition of the skin which he had observed in two patients and which was characterized by certain clinical and histologic features. The lesions appear as single or multiple papulo-squamous nodules in the skin that are sharply circumscribed from the surrounding area. They may be pale or dark red in color. The nodules are firm, slightly raised above the skin, and smooth or papillomatous on the surface. Two years later Darier² reported four further cases, in which he confirmed the findings of Bowen, and minutely described the microscopic structure of the cells that showed the abnormal features. Since then, many cases have been reported from observers in different parts of Europe and America which have essentially supported the earlier observations and have substantiated the opinion of Bowen that the initial lesion, if not completely eradicated exhibits a decided tendency to an eventually malignant transformation. The clinical form of the disease of the skin is extremely variable and may appear as simple erythematous spots (initial stage of Darier), as papules, or as crusty, hyperkeratotic, vegetating plaques. The microscopic characters, however, are remarkably constant. It has therefore been suggested—I believe wrongly—that the disease entity, if it exists at all, is more in the nature of a

histologic pattern than a definite clinical condition. Similar histologic changes have been described in localized patches on the mucous membranes, particularly the vulva (Richon³), glans penis (Jessner⁴), and the tongue. Recent reviews by Stout⁵ and by Cipollaro and Foster⁶ have fully described the known facts regarding the location and malignant manifestations of the disease.

The following case is described because the original lesion and the repeated recurrences presented all the histologic characters of Bowen's disease in the epithelium covering the sclerotic of the eyes. It was probably the first case of the disease reported⁷ in that location, and it had been observed for more than eight years until the death of the patient from some other cause. Recently McGavic⁸ has reported five specimens from the Eye Institute, New York, which he believed showed the histopathologic changes of Bowen's disease occurring in the cornea and conjunctiva. McGavic has stated that "the clinical course of the lesions is so unusual, the microscopic picture so characteristic, and the problem of therapy so challenging that a discussion of the subject is in order." I had hesitated to report the case fully as my opinion regarding the nature of the lesion was at variance with that of an eminent English ophthalmologist, and the patient was under observation until recently.

* From Tata Memorial Hospital.

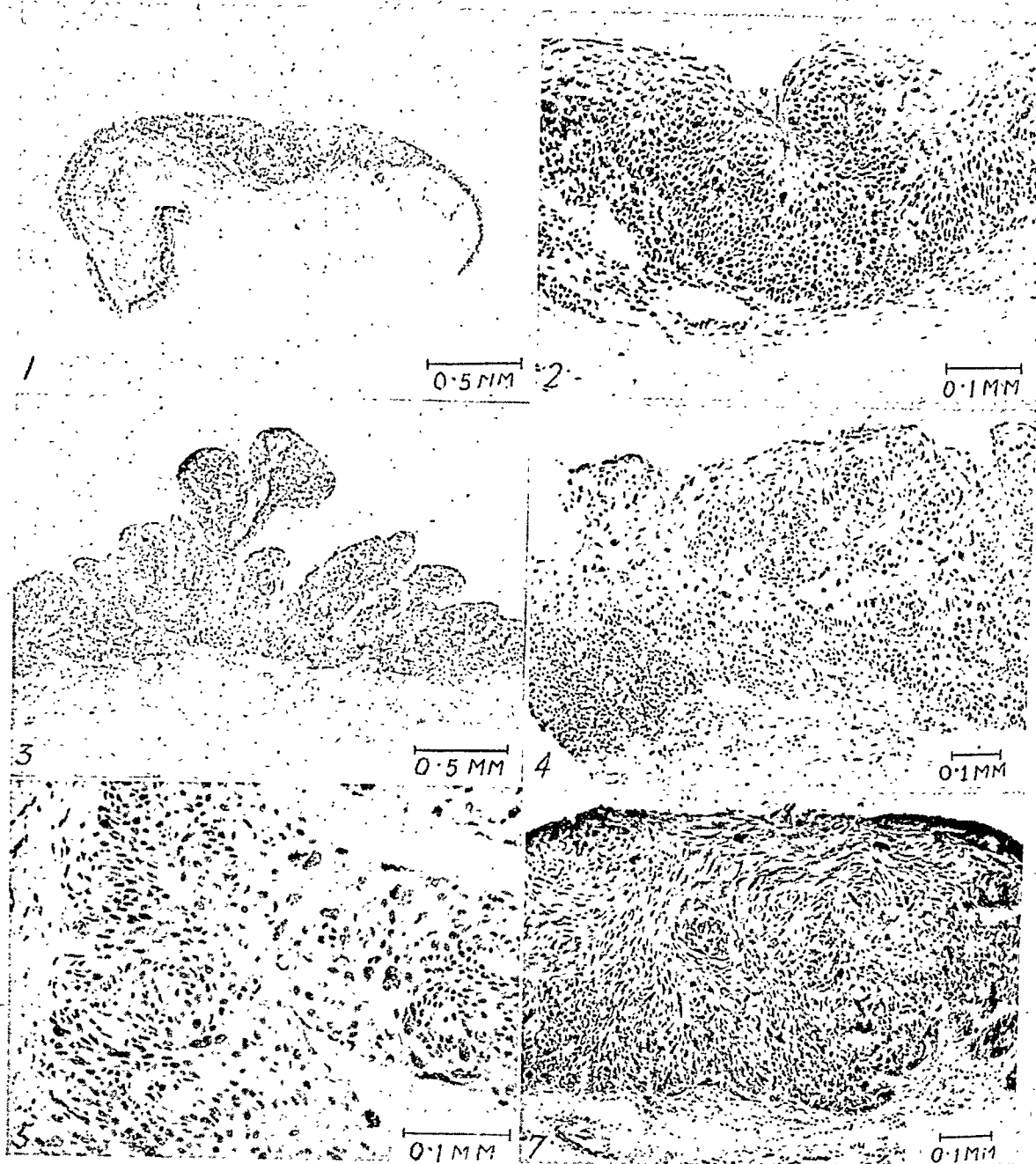


Fig. 1 (Khanolkar). Photomicrograph of a section of the entire tissue removed on January 11, 1938, showing a sharp transition from the normal epithelium at the periphery to the thickened altered conjunctival epithelium in the neoplastic zone. The epithelial cells are disposed in a disorderly manner, and there is a tendency to folding of the thickened epithelium. The epithelial cells are clearly demarcated from the subepithelial tissue, which shows increased vascularity and a mild inflammatory reaction.

Fig. 2 (Khanolkar). A photomicrograph of the tumor area in figure 1, showing a proliferation of the epithelial cells, a loss of the neat palisade arrangement of cells in the basal layer, and a marked variation in the size and shape of squamous cells (poikilokarynosis). A few giant cells and cells with multiple clumped nuclei are also seen. Two very large cells with a bizarre arrangement of chromatin are present.

Fig. 3 (Khanolkar). Photomicrograph of the central portion of the tissue excised on May 11, 1938. The epithelium is thrown into well-marked folds and papillary processes. The histologic characteristics of the tumor cells remains similar to those in the original lesion.

Fig. 4 (Khanolkar). Photomicrograph of a small area from one of the papillae in figure 3.

CASE REPORT

A physician, aged 70 years, noticed an acute inflammation of the conjunctiva of his right eye for the first time in January, 1936. He had lost his left eye as a small boy following an injury on the cricket field, and he attributed the conjunctivitis to an undue strain on the eye during the course of his work. The inflammation subsided after a couple of days of treatment with drops of 10-percent argyrol solution. The conjunctivitis began to recur every three to four months, but cleared up every time after a short course of argyrol instillations. In July, 1937, a fresh attack of conjunctivitis did not clear up completely with the usual treatment, but left an injected patch half way between the limbus and the outer angle of the eye, with two or three dilated blood vessels coursing across it. The presence of the patch was attended by no pain, although it led to a feeling of discomfort, yielding a sensation of a foreign body on the eyeball. Treatment with the usual medicaments led to no improvement of the condition. Three months later (October, 1937) the patch appeared to be slightly raised above the surface, reddish in color, and irregular in outline. A few weeks later the affected area began to spread rapidly and encroach on the limbus. The case was diagnosed as a papilloma of the conjunctiva by Dr. B. P. Banaji and he decided to excise the involved portion of the conjunctiva. At the operation (January, 1938) the conjunctiva of the affected area was removed by a superficial incision, and the underlying sclera was scraped. The nodule was not adherent to the deeper

structures (figs. 1, 2). The area that had been operated on healed completely without leaving any noticeable scar. The excised tissue was examined histologically and was reported upon by me as follows: "The conjunctival epithelium in the healthy portion, which is slightly thinned out, passes abruptly into

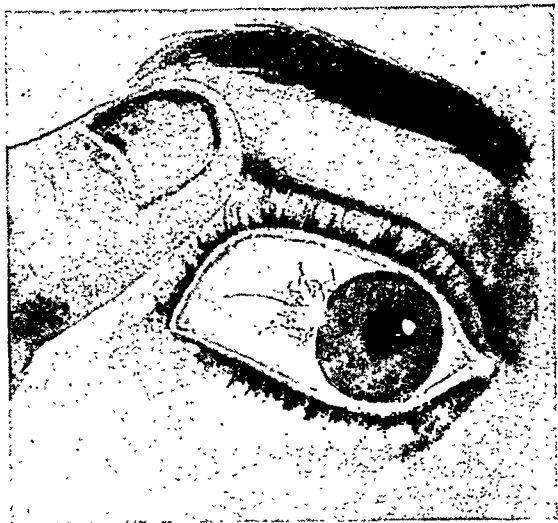


Fig. 6 (Khanolkar). Clinical appearance of the lesion as seen on the occasion of the third recurrence in April, 1939. The vascularity of the lesion is noticeable.

an epithelial lining several layers thick. In this affected area the epithelium is slightly folded with a small amount of keratinization in the most superficial layers. The normal arrangement of cells appears to be disturbed in the altered epithelium, and certain large cells are seen sprinkled or grouped between normal cells without any definite arrangement. These cells were about 8 to 10 times the size of normal polyhedral cells. Some of them showed the chromatin arranged in atypical mitotic figures lying in the middle of finely granular cytoplasm, whereas others were found

Fig. 5 (Khanolkar). A higher-power photomicrograph to show the microscopic features of the tumor cells. The "clumping cells" of Bowen and the "corps ronds" of Darier are easily recognizable.

Fig. 7 (Khanolkar). Photomicrograph of the nodule excised in April, 1939, showing a whorled arrangement of elongated spindle-shaped epithelial cells and their anaplastic character.

with several large nuclei clumped together in the center of monstrous cells. Some of the remaining cells, which were about normal in size, showed hyperchromatic dense nuclei surrounded by clear spaces (intracellular edema). Many darkly staining round clumps of chromatin are seen surrounded by clear zones ('corps ronds' of Darier). None of these cells is seen to be lying disassociated from its neighbors in clear spaces of intracellular edema. The fine clear lines separating the epithelial cells are clearly seen in most areas. A rapidly proliferative activity in the cells is evidenced by a large number of mitoses in the thickened epithelium. The subepithelial tissue consists of a richly vascular connective tissue with a mild inflammatory exudate mainly consisting of lymphocytes and histiocytes. *Diagnosis:* There is evidence of an atypical change in the cells of the squamous epithelium suggestive of a precancerous condition (Bowen's disease.)"

Three months later a small opaque nodule appeared near the site of the original lesion and was removed on May 11, 1938. A histologic examination of the excised piece showed that the affected epithelium was thrown into folds or papillary processes, but there was no evidence of infiltration of epithelial cells into subjacent connective tissue. The tumor cells presented a more advanced atypical change than those in the first piece, with evidences of a more noticeable variation in the size and shape of cells (figs. 3, 4, 5). The patient was naturally worried about the condition of his only existing eye and went to England for consultation and advice. He was seen by one of the leading ophthalmologists in that country in June, 1938, and the following opinion was given: "I have examined the slides which Dr. — has shown me and I am satisfied that the original growth, which was removed in January, is a simple papilloma

without any trace of malignancy. The recurrence which was excised in May is again a simple papilloma, but the slightly different character of some of the cells would lead me to suggest that if it recurs, which it probably will, it should again be excised widely and radium applied for some days after" (June 23, 1938).

There was another recurrence soon after the patient's return to India, in August, 1938, on the conjunctiva near the area which had been removed in October, 1938. The histologic characters of the excised nodules were again reported as being similar in structure to the original piece examined in January.

The patient remained well for the next five months (until March, 1939), when it was noticed that a small white nodule had appeared on the conjunctiva near the limbus. It did not appear to grow much during the first fortnight but took on an accelerated growth thereafter. It was noticed that the nodule had reached a diameter of 3 mm. in the next fortnight. It was raised above the surface, grayish white in appearance, and showed a fine network of dilated blood capillaries at its periphery. In its medial spread it had passed the limbus and was extending on to the cornea (fig. 6). The nodule was removed in April, 1939 (fig. 7), with a wide margin of conjunctiva beyond its outer limits.

The histologic features of the last piece deserve a detailed description. "A small nodule of thickened conjunctival epithelium is seen continuous with the adjacent epithelial lining. The tumor tissue is sharply demarcated from the underlying vascular connective tissue. The nodule is almost entirely composed of bundles or whorls of elongated spindle-shaped cells with few multinucleated cells scattered in the tissue. The spindle cells show all stages of transition from the polygonal

squamous epithelial cells. The chromatin in the nuclei of the tumor cells is dense and compact. The chromatin network and nucleoli are not clearly seen. There appears to be a marked variation in the size and shape of cells. *Diagnosis:* Spindle-cell carcinoma of the conjunctiva."

The patient went for further treatment to England in May, 1939, and was treated with two applications of radium. He could not receive the third application owing to the outbreak of hostilities in Europe and his desire to return to India immediately. Details of dosage and method of radium therapy employed in the case are not available. There was no recurrence of the eye lesion up to the time of the patient's death, 4½ years later.

DISCUSSION

The case presents many interesting features in as much as it was possible to observe the initial lesion and the three subsequent recurrences over a period of three years and to follow the course of the disease from the earliest subjective disturbances till the death of the patient 8½ years later. It was possible to study the histology of the tissue removed on

four different occasions, when it was observed that the structure manifested a progressive alteration from a relatively benign lesion to a definitely malignant tumor. The question of treatment in these cases has given rise to conflicting opinions. It may be suggested that an alert ophthalmologist should, in a suspected case, remove the whole superficially situated nodule by surgical excision and send the tissue for a careful histologic investigation. Treatment by irradiation may be immediately instituted if the lesion is reported to be Bowen's disease of the conjunctiva. The treatment of choice would be utilization of the unfiltered radiation from a bare radium bulb. The total dose would comprise about 500 millicurie-minutes, distributed over two to three applications at intervals of a fortnight.

SUMMARY

One more case of Bowen's disease of the eyeball has been described, which had been under observation for a period of 8½ years. The clinical and histologic findings have been described and the treatment of the disease has been discussed.

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PREGLAUCOMA*

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Ever since I first proposed the term "preglaucoma," in 1924, to designate the condition in which an ocular hypertension may be expected to develop in the course of time (one year previously Koeppe had used the term "preglaucomatous stage" in referring to the pigment disturbance he described), much work has been done and much has been written about tests to confirm such diagnosis. But nothing has been said about the type of hypertension that can be anticipated from the character of the preglaucomatous eye, and it seems to me of importance that such definite differentiation be established. Not only will the type of preventive treatment vary but the visual prognosis for the patient also varies greatly.

Two forms of ocular hypertension can be foretold from the preglaucomatous condition: first, the acute, shallow-angle type with the manifestations of acute decompensation; and second, the chronic, deep-angle form, with its insidious onset. The conditions of the eye before the onset of either form are entirely different, and in many cases can be recognized easily without recourse to provocative tests. It is of the utmost importance that such differentiation be made as complete as possible; for in one case provocative tests could lead to irreparable disaster, whereas in the chronic form such tests may be made with impunity. In consequence, a careful clinical study is indicated as the first measure.

As the knowledge concerning ocular hypertension has progressed in the past 25 years, it has become recognized that

an impending disturbance of ocular-pressure balance causes certain signs and symptoms that can be detected upon careful search. In as much as nearly 20 percent of all blindness is due to glaucoma, it behooves the ophthalmologist to suspect the possibilities of that condition in every patient past the age of 30 years; and his examination of all such patients should include those aspects which, if suspicious, would warrant further investigation with a view to determining whether preglaucoma exists. But such precautions can be carried to excess, and to perform elaborate provocative tests upon all patients is just as senseless as to neglect them in suspicious cases. What, then, are the appearances that should indicate further investigation as to the existence of a preglaucomatous state?

First to be considered are the eyes that may develop acute hypertension. The history that can be obtained from the patient is of great significance, greater than in the chronic type. The description of prodromal attacks of acute hypertension, lasting from one-half to three or four hours, is, as a rule, so characteristic that the diagnosis is obvious. Furthermore, the history of pain developing after an emotional or physical disturbance or after a stay of upward of 15 minutes in the dark, occasional halo vision, decreased visual acuity, moderate injection of the eyeball, gastric disturbances, or partial shock with spontaneous recovery, is of utmost significance. Only a limited number of preglaucomatous patients have had prodromal attacks, but other significant features can be elicited. Headaches that appear with fairly constant regularity after 10 to 15 minutes in a dark room,

* Presented at II Pan-American Congress of Ophthalmology, at Montevideo, Uruguay, November, 1945.

such as at a cinema, are of importance. A slight decrease in dark adaptation, as noted by an intelligent patient, may be of diagnostic significance but is not common.

Such patients are seldom under 45 years of age or more than 70. Refraction plays a far greater role in eyes likely to develop acute than it does in those that will develop a chronic glaucoma, as myopia, even of a moderate degree, is seldom present. A moment's reflection will recall the fact that the myopic eye is larger than the average normal in antero-posterior measurements, and in consequence the anterior chamber is deeper and the angle of the chamber is less acute. Goniometric measurements by Sugar and myself have shown the mathematical value of the angle in myopia to be greater than that in hyperopia, usually. In consequence, there is less possibility of blockage of the trabeculum by the root of the iris; in fact, the danger of chamber-angle occlusion is negligible in the wider-angled chambers. Following the same line of reasoning, it can be understood that there are certain types of irides that can easily block the chamber angle; namely, those in which the antero-posterior thickness is somewhat greater than the average and in which pupillary dilatation can cause an undue increase in antero-posterior thickness of the iris root. In every eye in which there is the anatomic predisposition to acute glaucoma, there exists a definite threshold of pupillary dilatation. By that is meant that when the pupil dilates beyond the given threshold of that eye, it is accomplished by such an increase in the antero-posterior thickness of the root of the iris that there is formed a blockage of the chamber angle and of the trabeculum, with the consequent acute rise in intraocular pressure. As yet there is no means of determining what that threshold is in the individual eyes. For

that reason, certain provocative tests are definitely contraindicated in the preglaucomatous stage of the acute-glaucoma type.

In patients who have had definite prodromal attacks, remains of such attacks may be seen in one or both of two forms. The first is a slight irregular dilatation of the pupil, usually upward, and involving about one quarter of the periphery, as though there had been a partial paralysis of the sphincter pupillae, which probably had occurred. The second is a partial sector-shaped disappearance of the iris stromal chromatophores, resulting in a limited area of light decoloration. This has been seen in blue irides, but is more common in the darker brown ones. Never is there the complete washed-out appearance that so frequently persists after an actual, acute attack. This pigment disturbance must not be confused with the Koeppel pigment-granule appearance that is found so frequently in compensated glaucoma.

To recapitulate briefly, when a patient in the fourth, fifth, or sixth decade of life presents a history suggestive of real, prodromal attacks or a history of headaches developing after a short period of absence of light, or after emotional excitement, the eyes should be examined most carefully from a standpoint of preglaucoma of the acute type. The depth of the anterior chamber, the estimation of the mathematical value of the angle of the chamber, the size, shape, and reaction of the pupil, and the appearance of anomalies of pigmentation of the iris must all be taken into account. Abnormalities of the visual fields, either central or peripheral, need not be looked for, for field changes do not occur. Neither will there be variations in tension from what may be the normal for that eye. Visual acuity will not be disturbed except by any refractive error that may be present.

If the suspicions of the ophthalmologist are sufficiently aroused, certain provocative tests may be undertaken; but they are less apt to yield positive information than similar tests in preglaucoma of the chronic type. Under no circumstances should provocative dilatation of the pupil be performed except in a patient with a highly suspicious eye who lives so far away from ophthalmologic care that an acute attack would spell certain blindness before relief from the hypertension could be obtained. But taken by and large, the diagnosis of preglaucoma of the acute type is dependent rather upon the experience of the ophthalmologist than upon positive information given by provocative tests.

When the ophthalmologist has decided in his own mind that he has to deal with a preglaucomatous condition of the acute type, it becomes his function to institute measures aimed at preventing an acute attack. If the chamber angle is very acute and if there have been prodromal attacks, the use of miotics alone as a preventive measure probably will not suffice, and the patient will have to be persuaded that his visual future depends upon preventive surgery. Peripheral iridectomy, freeing at least 25 degrees of the entire chamber angle, will prevent further hypertension. The iridectomy should be bilateral. But if there have been no prodromal attacks and if the chamber angle is not too acute, miotics will, as a rule, be adequate to prevent acute hypertension. However, it is just as great a mistake to use miotics of too great concentration and at too frequent intervals as it is to use no miotic at all. A solution of 1-percent pilocarpine should be instilled in both eyes at bedtime, as well as before any period of use of the eyes in the dark, such as at the cinema. The patient must be told of the dangers of pupillary dilatation and how this can be

avoided by the use of the miotic, in order that there may be intelligent coöperation on his part.

Considerably more clinical acumen is required to detect preglaucoma of the chronic type. Primarily, the history affords but few clues, for there have been no acute attacks nor headaches nor disturbed visual acuity. In some intelligent patients a definite story of decreased dark adaptation can be elicited, but that is not constant. In a large percentage of cases, heredity plays a definite role, and frequently the patient knows of definite glaucoma in a parent or a sibling. Consequently, with the lack of a definite anamnestic aid, the suspicion of preglaucoma must come objectively. The range of age is much greater, for chronic glaucoma of the compensated type is not uncommon in the third decade of life (or even earlier—I recall one case in a myopic girl of 13 years) and may appear at any time as long as the person lives. Refraction does not seem to play any role of importance, as hyperopia is present in 65 percent of the cases and myopia in 35 percent. That is approximately the comparative percentage of refractive errors in normal individuals of the same age group in this country. The depth of the anterior chamber is usually that which may be considered normal for the patient's age, with the single exception that under mydriasis the chamber has a tendency to become slightly shallower. When examined gonioscopically, the angle of the anterior chamber is always open and usually has a mathematical value typical of wide-open angles. In other words, there is no indication of possible blockage of the angle by the iris root. In some cases there may be a slight increase in the pigment granules or dust, seen so frequently on the surface of the trabeculum. Likewise, there may be the Koeppe pigment dotting of the surface or anterior

stroma of the iris, a finding that is suspicious but not diagnostic.

The pupil tends readily to dilate somewhat unduly, but the reactions are normal, even to the hippus-like reaction that occurs when the narrow beam of the slitlamp falls upon the pupillary border. In some cases (the percentage is not yet known) exfoliations of the anterior capsule of the lens are present, and while these are not to be taken lightly, still the presence of that condition is not absolutely diagnostic of either glaucoma or preglaucoma. In true preglaucoma of the chronic type, there are no abnormalities in the fundus nor in the optic nerve attributable to that condition.

When the ophthalmologist's suspicions have been aroused to the extent of making a complete perimetric examination, defects of the peripheral fields of a hypertensive character cannot, as a rule, be elicited. In a few cases, slight notching of the inferior nasal field can be demonstrated by the use of a marked reduction in intensity of illumination; however, this finding is not sufficiently constant to justify a routine examination of that type. But in the central fields there is not infrequently a rather significant enlargement of the blind spot of from 1 to 5 degrees. The cause of such enlargement is unknown. It is definitely not due to hypertension, as is frequently the cause in cases of established chronic compensated glaucoma. The other central-field defects that are usually found in chronic glaucoma have not yet made their appearance.

Consequently, when the suspicions of the ophthalmologist have been aroused, the diagnosis of preglaucoma of the chronic type must be established or refuted by provocative tests. Many have been described and practically all are based upon varying amounts of increase in intraocular pressure produced by vari-

ous procedures. Probably the most reliable of all is an increase in pressure of more than 8 mm. Hg, measured tonometrically, as the result of the drinking test or after instillation of a mydriatic; but even this is not characteristic. Positive responses to the various provocative tests are significant, although not absolute, whereas negative responses mean very little if anything at all. So the diagnosis of preglaucoma of the chronic type becomes a function of the clinical acumen and experience of the ophthalmologist, plus some aid from provocative tests.

After such diagnosis has been established, it becomes the function of the ophthalmologist to utilize that knowledge for the benefit of the patient to prevent, in so far as possible, the gradual development of a chronic compensated glaucoma. While this is not always possible, the process may at least be retarded. A weak miotic, usually 1-percent pilocarpine nitrate, may be instilled regularly at bedtime, and this usually is sufficient, although the reason why is beyond our ken. Here, as in preglaucoma of the acute type, the too-frequent use of too strong a miotic may be just as damaging as the complete neglect of the miotic. This latter point must be impressed, especially upon neurotic patients who are apt to run to the pilocarpine bottle upon the slightest provocation.

SUMMARY

Preglaucoma may be divided into two forms: that which may be the predecessor of an acute glaucoma, and that which may be followed by a chronic glaucoma. The two forms can be differentiated clinically and require different types of provocative tests for confirmation. When recognized, preglaucoma necessitates preventive treatment.

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SYNDROME OF UVEITIS, MENINGO-ENCEPHALITIS, ALOPECIA, POLIOSIS, AND DYSACOUSIA*

REPORT OF A CASE DUE TO ACTINOMYCES

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Ophthalmologists recognize a syndrome of chronic bilateral uveitis in association with alopecia, poliosis, vitiligo, and dysacusia. The following report appears as a slight variation of this clinical entity. Duke-Elder¹ has presented a classical description of the usual syndrome with an excellent report on the literature. The senior author has seen two cases, both in adolescent individuals. The profound diseased state of the eyes is striking and once seen cannot be easily forgotten.

The uveitis is widespread and insidious, and generally begins in both eyes at about the same time. The exudative character of the choroiditis may lead to retinal detachments, and vitreous opacities increase gradually until an adequate view of the fundus is no longer possible. The usual sequelae of uveitis develop with or without treatment until a pigmentary atrophy is prominent. Following the severe inflammatory process the signs of uveitis gradually abate, often with permanent irreversible changes and considerable destruction to the ocular tissues.

Alopecia areata involving the hair of the head, eyebrows, and lashes frequently occurs in a matter of weeks after the uveitis. Poliosis (whitening of the hairs) occurs in a high percentage of cases.

Duke-Elder² states that vitiligo and temporary deafness, lasting four to six weeks, occur in about half of the cases and come on soon after the eye symptoms. Hamada³ appears to have been among the

first to call attention to the central-nervous-system involvement with headache, vomiting, spinal-fluid lymphocytosis, and increased pressure. The disease is apparently self-limiting, although the course may be a matter of months.

The etiology of the disease has been given as unknown, and the treatment considered as entirely symptomatic. Toxic, virus, and allergic theories have been advocated.

Hague⁴ has given an excellent review of the subject and has presented an additional case showing a transient encephalitis. The relationship between the neurodermatoses (alopecia, vitiligo, and poliosis) and the intraocular-pigment disturbance is noteworthy. The role which the hypothalamus plays in organic-pigment disturbances of this nature is well presented by the aforementioned writer. That the encephalitis might affect retino-hypothalamicohypophysial vegetative fibers which control pigment seems likely. In a case of a tumor of the third ventricle⁵ pressing upon the hypothalamus, similar diffuse pigment disturbances were noted. There is good evidence that any irritative action in this region of the hypothalamus may produce this spotty depigmentation.

Hague also draws attention to the similarity of the uveitis syndrome and sympathetic ophthalmia with respect to symptoms and histologic features. There is some evidence for a virus etiology for both ocular conditions but substantial proof has been scant.

In Givner's⁶ case, aqueous and iris tis-

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sue produced no virus growth in a series of chorioallantoic and yolk-sac inoculations. He cites several other workers who have had inconstant success with the production of optic neuritis and uveitis from the inoculation of vitreous from affected eyes. No microorganisms were found in the ocular fluids or tissues.

Carrasquillo⁷ has reported carefully on 29 cases which included all the cases other than those tabulated by Koyanagi in 1929. He concluded that a neuropathic factor of sympathetic activity was operative in the uveitis syndrome.

Rosen⁸ found the syndrome of bilateral uveitis, alopecia, poliosis, vitiligo, and dysacusia described in the literature 47 times. He states that the Vogt-Koyanagi syndrome always occurs in darkly pigmented persons. In analyzing the 47 cases for the extraocular signs he reports that alopecia occurred in 31 of 40 cases, poliosis in 43 of 47 cases, vitiligo in 30 of 47 cases, dysacusia in 24 of 44 cases, and cephalgic symptoms in 21 cases.

Hamada⁹ observed 10 cases of acute diffuse choroiditis (Harada's disease), which was first described by E. Harada. However, Hamada states that often these cases were accompanied by meningeal symptoms; that is, headache and lymphocytosis in the cerebrospinal fluid. Vestibular, cochlear, skin, and hair changes were also noted. The uveitis in all cases was diffuse, without distinct nodular formation. The fundi first exhibited localized multiple retinal swellings due to edema, especially distinct about the disc and macula. In a few days the edema fused and a distinct neuroretinitis could be observed. In 7 of the 10 cases a retinal detachment was present. These fundus changes disappeared gradually after two or three months, leaving a fine mottling in the fundi. The central nervous system, vestibular, cochlear, cutaneous, and hair manifestations were observed either be-

fore, during, or after the ocular symptoms became apparent.

Hamada histologically examined those eyes with this form of acute, diffuse choroiditis. He found the proliferating modifications of the uvea manifested by gradual destruction of the pigmentary cells (chromatophores). Pigmentary granules were frequently found in the epithelioid and giant cells in a phagocytized form. After one to three months it was noted that the proliferating and exudative modifications had disappeared and the structures had become atrophic.

The distinction between acute diffuse choroiditis (Harada) and the syndrome of uveitis, vitiligo, poliosis, alopecia, and dysacusia (Vogt-Koyanagi syndrome) with or without meningo-encephalitic signs does not appear clear cut.

On the other hand, the clinical appearance of sympathetic ophthalmia compared with the uveitis in the syndrome of alopecia, vitiligo, poliosis, and dysacusia is striking.

Exudative retinal detachments, poliosis, and deafness have been noted as occurring in sympathetic ophthalmia. Systemic symptoms indicating meningeal involvement have also been observed in sympathetic disease (Snellen,¹⁰ Risley,¹¹ and Luque¹²).

It would appear that there is a common denominator in all three forms of this chronic uveitis.

The following case report of uveitis in association with meningo-encephalitis, alopecia, poliosis, and dysacusia illustrates the profound effect that the disease has upon the eyes as well as on certain other systems. The clinical appearance of the eyes might easily pass as sympathetic ophthalmia and perhaps it may be but a variation of this condition.

The recovery of *Actinomyces* in this case was so clearly proved to us, both from direct smear and animal inocula-

tion, that we felt it was worthy of report.

Sympathetic ophthalmia has been explained as an anaphylactic phenomenon through sensitization to the uveal pigment. It is suggested that in our case the organism, *Actinomyces*, began the ocular inflammatory state which resulted in uveal-pigment destruction. The liberated pigment antigen may have then initiated the anaphylactic process which resulted in further pigment break down in the eyes, hair, skin, and ears. If it is true that some pigment¹³ occurs in the basilar membrane of the labyrinth, then disturbance of this pigmented structure could explain the dysacusia.

The idea that the liberated iris pigment sets the stage for the anaphylactic process which results in a severe bilateral uveitis is not new. The missing link in the puzzle has been what liberates the pigment. In the nontraumatic form of this severe uveitis it has been found that *Actinomyces* can at least act as one of the initial causative agents. The uveitis in this syndrome may be likened to a nontraumatic form of sympathetic ophthalmia.

CASE REPORT

The patient, a Puerto Rican soldier, aged 19 years, was first seen as an outpatient at an overseas general hospital about January 1, 1944, complaining of a severe frontal headache and loss of appetite. His familial and past personal history were unrevealing except that the patient stated that he had been bitten by a scorpion about two weeks prior to the onset of his symptoms. About January 6th the headache lessened, but soreness of the left eye and blurred vision were experienced. Two days later soreness and blurred vision of the right eye were noticed. His visual loss steadily increased, so that in a few days he was unable to read. He stated that his vision was normal on entry into the Army. Chills, nau-

sea, vomiting, and dizziness developed, and he was admitted to the hospital on January 14, 1944.

Physical examination. Examination on admission revealed dilated pupils which responded poorly to light. The scleral and conjunctival vessels were moderately congested, and there was a horizontal nystagmus on left lateral gaze. The disc margins were reported as indistinct, and the retinal veins appeared congested. There were no hemorrhages nor exudates. The nasopharynx was moderately congested. The remainder of the general and neurologic examination showed no abnormal alterations. The temperature was 97°F., and the respiratory rate was 18 per minute. The blood count was 4,520,000 red blood cells; 8,700 white blood cells; hemoglobin 85 percent; polymorphonuclear leukocytes 72 percent, and lymphocytes 28 percent. Urinalysis was normal.

Course in the first hospital. The patient's condition seemingly improved after admission to the hospital. The appetite increased, vomiting ceased, and he became ambulatory. The temperature remained between 97° and 98°F.

Two days later he again vomited. Inspection of the fundi on January 17th showed a bilateral papilledema. A lumbar puncture yielded clear fluid under 12 cm. of water pressure. There were 215 cells per cu. mm. and they were all reported as lymphocytes. The spinal-fluid sugar was normal, but the globulin was slightly increased. X-ray studies of the sinuses showed hazy antra, bilaterally. The maxillary sinuses were irrigated. The fluid return from the left antrum was clear, but that from the right was of a dark straw color. The culture from the right antrum showed hemolytic *Staphylococcus aureus*. On January 23d a bilateral, inferior retinal detachment was noted. The nystagmus on left lateral gaze persisted,

but otherwise no additional neurologic findings were uncovered. Vision was 20/200 O.U.

The senior author first saw the patient in consultation on February 9th. The presence of bilateral, inferior, symmetric retinal detachments was confirmed. There were many small, discrete, yellow and grayish spots in the periphery of both fundi which appeared to be multiple areas of focal chorioretinitis. There was an optic neuritis, bilaterally, measuring approximately 2D. elevation. The slit-lamp showed many keratitic precipitates and cells in the aqueous, bilaterally. The ocular picture alone resembled a bilateral, subacute neuroretinitis and uveitis with retinal detachments. The symmetry of the detachments was striking. The vision continued to become obscured because of the haziness of the media. The patient was given a course of sulfadiazine for eight days and then seven intravenous typhoid injections. The latter gave excellent fever responses. Four more spinal-fluid analyses were done, and the cell counts (reported as lymphocytes) ranged from 214 to 142 on March 3d. No polymorphonuclear cells were ever noted. Aside from a persistent slight increase in the globulin, the cultures, Wassermann tests, gold curves, and Queckenstedt's sign were repeatedly negative. The blood counts remained nearly the same as on the first examination; the white blood count rarely was found to be above 8,000. A blood culture showed no growth. Two sedimentation rates were identical at 3 mm. in one hour. Two blood-serum specimens were negative for lymphocytic choriomeningitis. Blood smears failed to show malaria parasites or microfilaria. Stool examination showed no parasites or ova.

Course in the second hospital. The patient was transferred to Gorgas Hospital, Ancon, Canal Zone, on March 30, 1944. Ocular examination showed that the haze

in the media had increased markedly. Vision was: O.D., perception of hand movements at one foot; O.S., finger counting at two feet. Keratitic precipitates and cells in the aqueous were seen in profusion. The elevation of the retinas could still be observed.

No new neurologic changes had been added at this time. Spinal-fluid cell counts

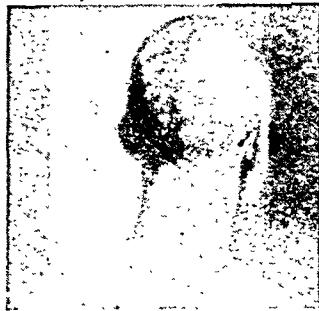


Fig. A (Harley and Wedding). Alopecia as noted at the end of 3½ months of illness.

on April 3d and 6th showed 30 and 20 cells present, respectively. Other spinal-fluid examinations, including cultures, were negative. Examinations for toxoplasmosis were negative.

By April 15th the retinal detachments were seen to have reattached, although the view was very poor, indeed. On April 25th, after approximately 3½ months of illness, several large areas of alopecia on the scalp were noted (fig. A) and it was at this time that the syndrome of uveitis, alopecia, poliosis, and dysacusia with meningo-encephalitis was diagnosed.

X-ray films of the skull were negative; of the chest and hands were negative for Boeck's sarcoid. The antra continued to show thickened membranes with straw-colored fluid returns and were treated by Proetz displacement. No vitiligo had been noted, even under ultraviolet-light inspection. The alopecia developed rapidly, and by May 1st the patient was three-fourths bald. Approximately half of the hairs of the eyebrows and eyelashes became white

in a few weeks. Spinal fluid and aqueous-chamber fluid were withdrawn and injected into laboratory animals (rats) on April 15, 1944. Tinnitus was complained of by May 1st. Audiograms done in April and June were within normal range, but in September another audiogram showed a definite nerve-type deafness.

Although atropine had been used topically for months the irides became plastered to the lenses and the pupils remained

hung over the pupillary area, and membranes had grown over both anterior surfaces of the lenses. The keratitic precipitates had diminished in number. Both eyeballs were soft to palpation. In the pupillary center of each cornea in Bowman's membrane was an irregular, yellowish, foamy collection appearing as an early degenerative corneal change, possibly an early band-shaped opacity.

In November 9th and December 28th

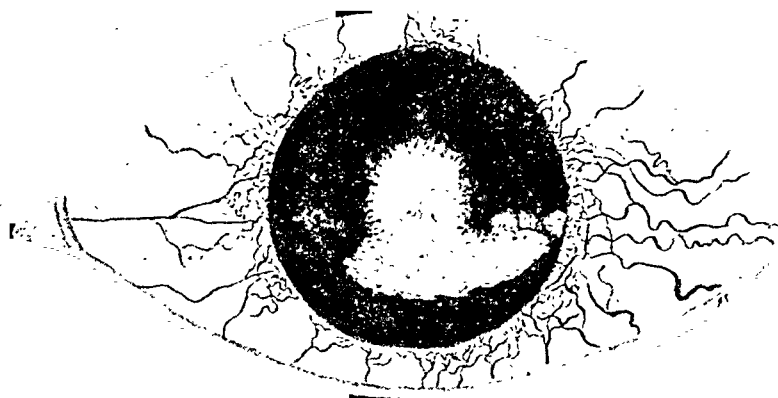


Fig. B (Harley and Wedding). Reproduction of left eye after one year of illness. Note the posterior synechia, secondary cataract, flattening of the iris pattern, and neovascular formations on the diseased iris. The cornea is the seat of a bandlike opacity.

in mid-dilatation. Secondary glaucoma developed in the left eye but was controlled by paracentesis. Later both eyes remained in hypotony.

By June 1st the hair on the head was beginning to return, but one quarter of it came back white. Treatment over a period of nine months at Gorgas Hospital has consisted chiefly of administrations of penicillin (400,000 U.), intravenous typhoid, heavy doses of salicylates, diathermy, and topical atropine. No treatment has been of any avail.

An eye examination on November 6, 1944, showed a moderately deep scleral injection, especially about the limbus. There were seclusio pupillae and extreme iris atrophy, since light concentrated on the sclera was easily seen through the muddy brown irides. Vascularization of the iris was prominent, but no nodules were present. A heavy gelatinous exudate

the spinal-fluid cell count was 3, all of which were lymphocytes. The spinal-fluid glucose was 72 mg. per 100 c.c. and sodium chloride was 745 mg. percent. An electrocardiogram was normal. The basal metabolic rate was +6. Blood serum failed to agglutinate stock cultures of *Brucella abortus* in any dilution. More fluid was aspirated from the aqueous chamber of both eyes for further laboratory study on November 6th. Ocular examination on January 23, 1945, showed an increase in the band-shaped opacity in both corneas (fig. B). It was more dense and had assumed a chalky white color and completely replaced Bowman's membrane in the lower third of the cornea. The gelatinous exudate in the aqueous had largely disappeared, but many keratitic precipitates remained. The irides, synechiæ, and cataracta complicata were unchanged. Light projection was some-

what faulty. There were two areas of alopecia, with graying hair returning in the lower occipital region.

The patient had suffered from a chronic rhinitis, catarrhal ethmoid, and maxillary sinusitis accompanied by a eustachian-tube obstruction since hospitalization. Allergy tests with 19 common allergens were made but only pyrethrum was moderately positive. Skin tests for coccidioidin,* histoplasmin,* and tuberculin in both first and second strength were all negative.

Since the patient would require a long convalescence, he was sent to the continent for further disposition. It is anticipated that cataract extractions may be attempted when the ocular inflammation has fully subsided.

BACTERIOLOGY AND MYCOLOGY†

The aqueous humor from each eye was withdrawn in sterile syringes and each placed immediately in a sterile test tube. Similar precautions were taken with the spinal fluid. The following condensed report of the laboratory findings is given:

Direct smear from eye. The grossly cloudy and somewhat granular-appearing fluid aspirated from the anterior chamber of both eyes showed on direct smear diffuse areas with innumerable small coccoid and small rodlike structures. They were predominantly of a purple color but also of basophilic appearance with Giemsa's stain. Some forms were spherical in contour and measured about 2 micra in diameter. A few bodies showed a definite budding form and measured about 2.0 by 4.7 micra at the largest dimensions (fig. 1). Two photographs showing mycelial elements recovered from the aque-

ous humor directly and from the culture of the meninges of an inoculated rat will be shown in another paper. Some purple and basophilic staining round bodies and rodlike structures appeared to be within the acidophilic staining cytoplasm of some of the cells. These cells had large basophilic staining, vesicular nuclei. A few slightly basophilic staining and septate nonbranching mycelial filaments were observed. Basophilic amorphous precipitate was also seen. Control smears for foreign material in stains showed no such similar structures.

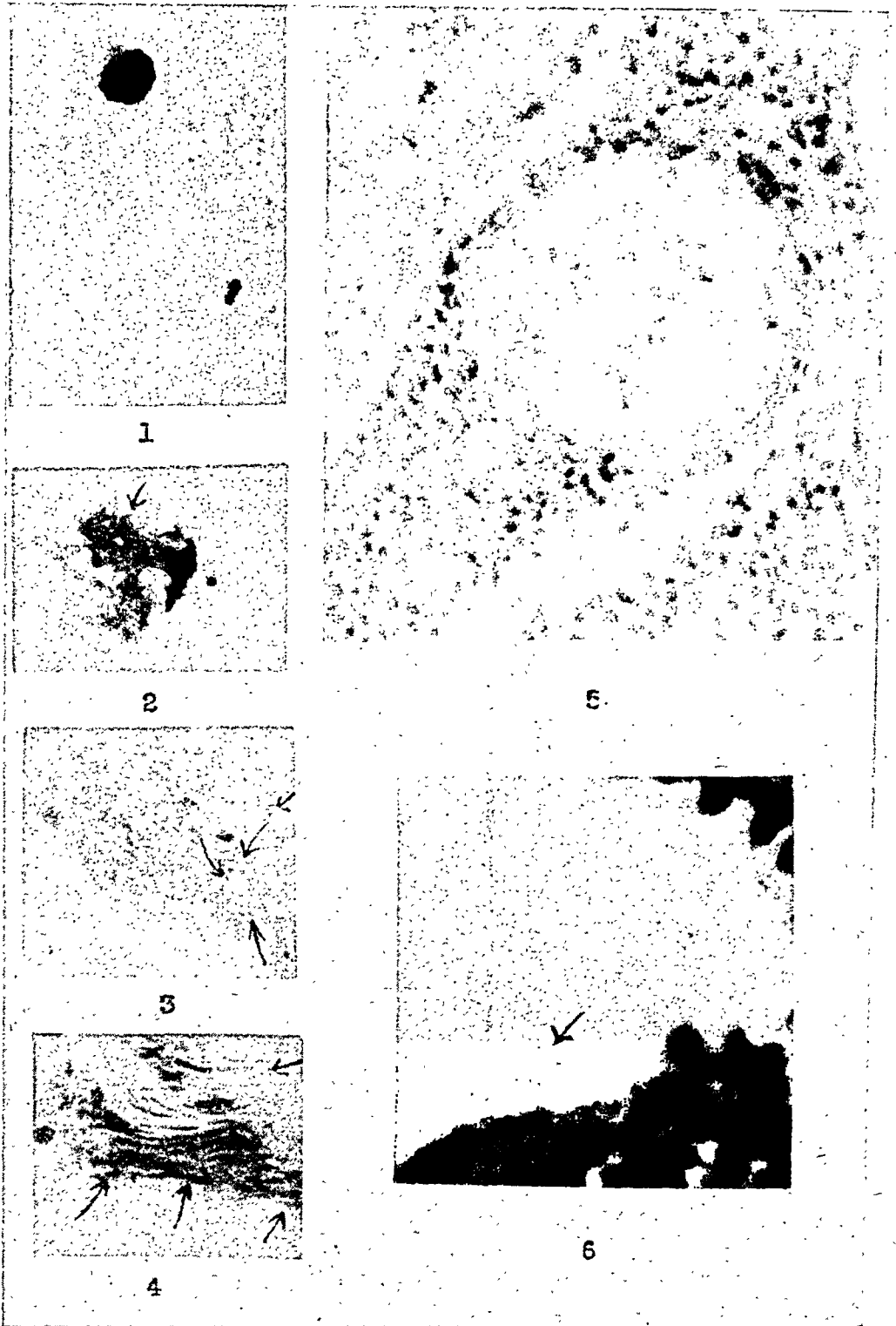
Direct examination of spinal fluid. Unfortunately, the spinal-fluid specimens were examined late in the course of the disease in this laboratory. The heavy turbidity reported at a previous hospital was at no time observed here. All spinal-fluid specimens were clear except for some red blood cells in one specimen. The maximum cell count was 30 lymphocytes per cu. mm. in the clear fluid. Smears stained by Giemsa's method and prepared from centrifuged specimens showed a few small rodlike and coccoid structures (fig. 2). These forms occurred isolated and in small groups and necessitated extensive search on numerous slides from various specimens. The stain varied from a deep basophilic to a purple appearance. Control smears were negative.

Cultures. Cultures from both aqueous humor and spinal fluid specimens were sterile aerobically and under CO₂ tension, although they were held for some time.

Animal inoculations. Fluid from the anterior chamber of the right eye was inoculated intraperitoneally into a female rat (no. 1) on April 15, 1944. The rat was killed October 8, 1944, and showed grossly mesenteric nodular structure, not recognized as any definite organ (fig. 9 a.). Numerous small pus pockets were situated over the surface.

* The coccidioidin and histoplasmin antigens were furnished by J. F. Kessel and C. W. Emmons, respectively.

† Acknowledgement is made to Dr. H. C. Clark of Gorgas Memorial Laboratory, R. de P., for use of photomicrographic equipment.



Figs. 1-6 (Harley and Wedding). Photomicrographic studies.

Fig. 1. Budding structure, as observed by Giemsa staining of direct smear from aqueous humor of the eye ($\times 950$).

Fig. 2. Rods (see arrow) and coccobacilli, stained by Giemsa's method, the direct smear from spinal fluid of patient ($\times 950$).

Figs. 3, 4. Cocci at different focus levels, as observed in hyalinized mass of cerebral cortex of rat no. 2 inoculated with spinal fluid of patient ($\times 950$; H. & E. stain).

Microscopically the mass was shown to consist of uterus, tubes, and ovaries, with focal and diffuse areas of inflammatory reaction over uterus and tubes and within the lumina of the tubes (fig. 7). Basophilic-staining cocci, diplococci, cocci in chains, and occasional diphtheroid structures were observed predominantly in the serosal exudate (fig. 8). A few cocci were seen within the lumina of the fallopian tubes and a few others were within polymorphonuclear leukocytes.

Spinal-fluid specimens of April 3 and 6, and of May 5, 1944, were all inoculated intraperitoneally into a second rat (no. 2) which was killed on June 30th. Uterus, tubes, and ovaries showed an irregular mass resembling the same structure described for rat no. 1 (fig. 9 b). No pus pockets were present over the external surface of this structure; but surfaces made by sectioning showed small pockets containing a yellow, viscid, and purulent-appearing content. The meninges presented a small, soft, gray nodule, the size of a small pinhead. Direct observation on a preparation from this nodule showed a few small rodlike structures.

Microscopic examination of a section of the lung presented a small abscess well walled off adjacent to some blood vessels and somewhat distant from the larger bronchial ramifications (fig. 5). The uterine cavity and lumina of the tubes were dilated and filled with inflammatory cells (fig. 10). Only a few microorganisms in the form of diphtheroid structures of basophilic staining were seen within the lumina of the tubes, uterine cavity (fig. 11), and ovarian follicles (fig. 6). Occasional basophilic cocci and diplo-

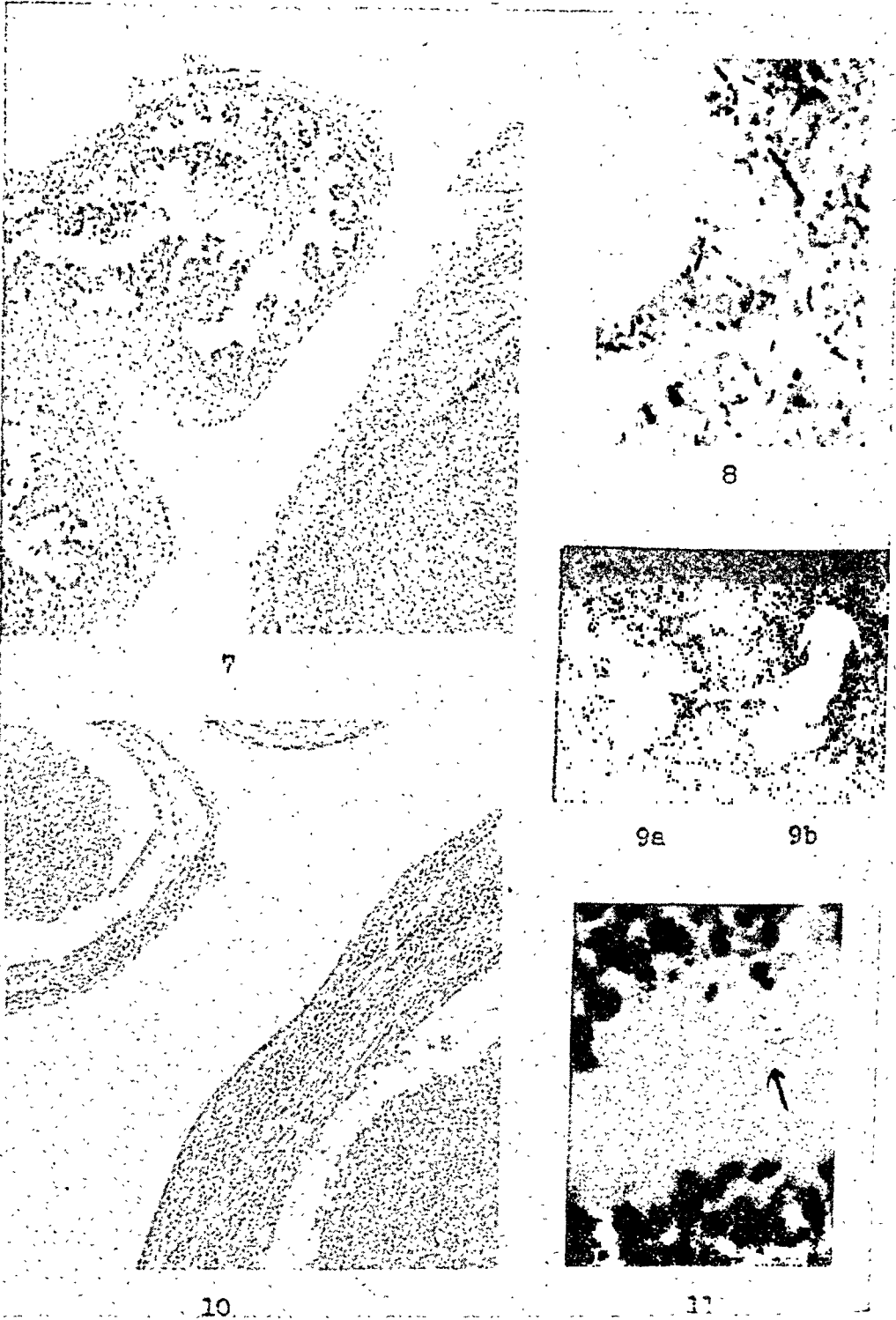
cocci were also present within the uterine cavity. An adjacent lymph node showed almost complete loss of architectural structure with focal areas of abscess formation. A section of the brain showed on the surface of the cortex a small zone of an eosinophilic-staining hyaline mass containing several basophilic-staining cocci and occasional diplococci (figs. 3 and 4).

A third rat was inoculated cisternally on November 6, 1944, with aqueous fluid aspirated from both eyes. This rat died in 24 hours, probably as a result of trauma to the central nervous system.

Cultural characteristics. Cultures were made aerobically and under CO₂ tension on Sabouraud's medium, blood slants, and in hormone broth. All aerobic cultures from both animals were sterile. Cultures grown under CO₂ tension from pus pockets over the external surfaces of the tubes and uterus of the rat inoculated with aqueous humor showed the same characteristics as the cultures grown under CO₂ tension from brain, meninges, and pus pockets of the uterus and tubes of the rat inoculated with spinal fluid. These cultures grew on blood slants and in hormone broth. Colonies varied from pinpoint in size up to pinhead. They were soft and of a gray to a gray-brown color. Sabouraud's cultures were sterile. In 24 hours the predominating structures were cocci, diplococci, and streptococci that took the gram stain variably but for the most part gram positively. Occasional filaments were observed after 48 hours. In 72 hours cultures under CO₂ tension showed acidophilic-staining branching filaments and predominantly basophilic-staining rods in addition to the forms de-

Fig. 5. Lung abscess with circumscribed tissue reaction of rat no. 2, inoculated with spinal fluid of patient (×400; H. & E. stain).

Fig. 6. Rods within follicular cavity of ovary of rat no. 2 inoculated with spinal fluid of patient (×950; H. & E. stain).

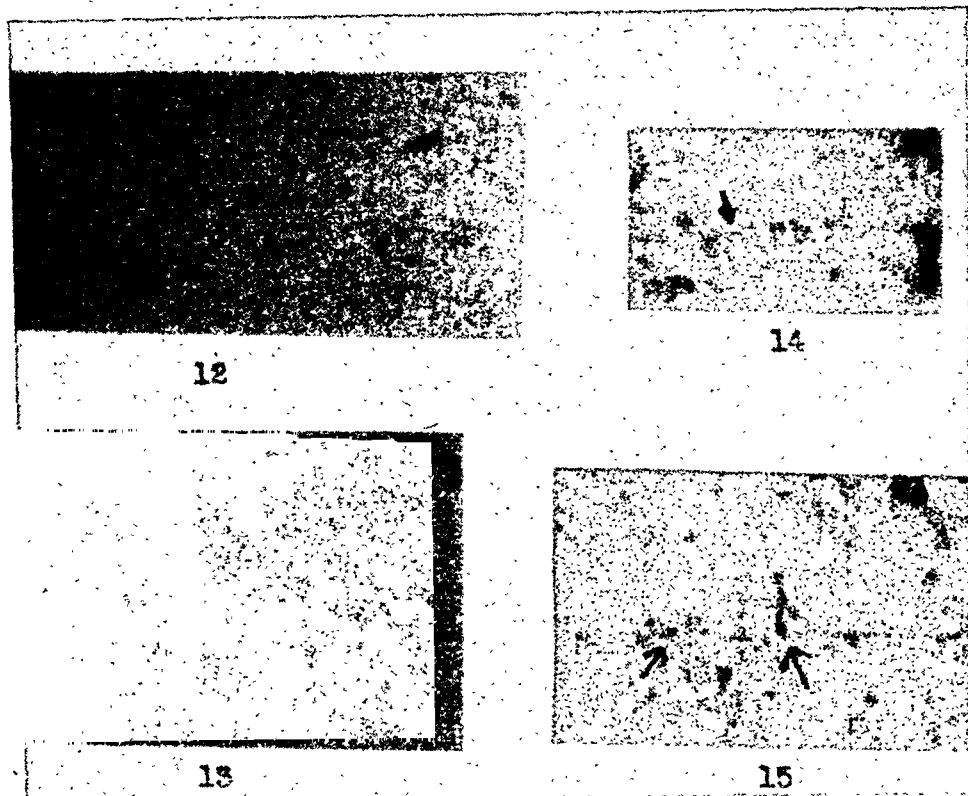


Figs. 7-11 (Harley and Wedding). Gross and photomicrographic studies.

Fig. 7. Microscopic section of fallopian tube and uterus of rat no. 1 inoculated with aqueous humor of eye ($\times 75$; H. & E. stain).

Fig. 8. Coccal, diplococcal, streptococcal forms and rods as seen in serosal exudate of Fig. 7 ($\times 950$; Gram's stain, MacCallum's modification of Goodpasture's method).

Fig. 9 a. Gross specimen of uterus, ovary, and tube of rat no. 1 inoculated with aqueous humor of eye ($\times 1\frac{1}{4}$).



Figs. 12-15 (Harley and Wedding). Photomicrographic studies.

Fig. 12. Coccal and streptococcal forms of 48-hour culture on blood slant under carbon-dioxide tension, from meninges of rat no. 2 inoculated with spinal fluid of patient ($\times 950$; H. & E. stain).

Figs. 13, 14, 15. Rods and branching filamentous forms from 72-hour growth on blood slants under carbon-dioxide tension from meninges of rat no. 2 inoculated with spinal fluid of patient ($\times 950$; H. & E. stain).

scribed (figs. 12-15). Some of the rods presented a resemblance to the morphologic appearance of those found in direct smear of the spinal fluid of the patient. Twenty-four-hour transplants of cultures grew but died within 72 hours, and further observations of developmental characteristics were not possible.

Correlation of findings. It is already well established that most pathogenic forms of *Actinomyces* are microaerophilic and that some of the pathogens in

this group are aerobic. There are various references in the literature that club formations are neither a criterion for, nor diagnostic of, *Actinomyces*. Emmons¹⁴ considers actinomycosis as an infection caused by invasion of the host by some of the species of *Actinomyces*. He also makes reference to variations of abnormal forms of this organism in culture. Kessel and Goolden¹⁵ refer to the diagnosis of actinomycosis by branching filaments and bacillary forms. The difficulty experienced in

Fig. 9 b. Gross specimen of uterus, ovary, and tube of rat no. 2 inoculated with spinal fluid of patient ($\times 1\frac{1}{4}$).

Fig. 10. Microscopic section of fallopian tube and uterus of rat no. 2 inoculated with spinal fluid of patient ($\times 75$; H. & E. stain).

Fig. 11. Diphtheroidlike structures among inflammatory cells within uterus of rat no. 2 inoculated with spinal fluid of patient ($\times 950$ magnification of section of fig. 10; H. & E. stain).

culturing the microaerophilic pathogenic forms of *Actinomyces* with subsequent loss of culture is a common occurrence. Pus from actinomycotic lesions that has been cultured on artificial media frequently shows no growth. The morphologic structures of actinomycetes simulating cocci, streptococci, and rods, together with branching filamentous forms, as is observed in the various developmental stages of the organism, have repeatedly been mentioned in literature. Novak and Henrici¹⁶ and Sartory and Meyers¹⁷ refer to a filterable form of the actinomycetes. Negroni¹⁸ refers to the flexed bacillary forms and the undulant filaments with short ramifications.

The organism recovered from the various lesions of the inoculated animals described in this paper has been classified as one of the species of *Actinomyces*, due to the observed developmental stages terminating in branched mycelial elements. It is important to note that specimens taken from the aqueous and spinal fluid when injected into separate animals produced a similar gross and histologic appearance of the involved structures with the recovery of the same organism from each of the two animals.

All specimens used for cultures and animal experimentation were handled only by the authors with utmost precautions to prevent contamination of specimens. Test tubes and syringes were sterilized twice immediately before being used. Aqueous humor aspirated from the eyes remained in the respective syringes and the syringes were immediately placed in sterile test tubes. No intermediary containers were used. Within a brief time the fluid was inoculated on media, into a rat, and placed on a slide for a smear which was protected in a sterile Petri dish. Spinal-fluid specimens were handled with equal care and precautions. Control smears were made for the presence of

possible contaminants in the stain. Fresh culture media were incubated 24 hours before being inoculated in order to guard against possible contamination in the process of making slants.

It is impossible to say from direct smear alone that a certain early stage of development of an organism is a particular organism. This can be done only by following the development of that organism and by observing its classified characteristics. The developmental stages of the *Actinomyces* mentioned in this paper will be discussed in somewhat greater detail in a separate paper.¹⁹ Further work is being done on a strain of *Actinomyces* recovered from animal experimentation in another case of severe meningitis. The round bodies, sproutlike or budding forms, and other structures mentioned in this paper have also been observed in the aforementioned case in which the organism has been kept viable.

SUMMARY

A syndrome of uveitis, meningoencephalitis, alopecia, poliosis, and dysacusia with the case report is presented.

This syndrome is probably closely allied to that form of uveitis ordinarily associated with alopecia, poliosis, vitiligo, and dysacusia.

A brief account of the reviewed literature is given.

Actinomyces were recovered from the aqueous and spinal fluid and studied by direct smear, animal inoculation, and culture.

It is suggested that *Actinomyces* from the aqueous in this case initiated the pigment liberation from the irides which resulted in pigment sensitization of the uveal tract and possibly other pigmented structures.

The fact that the organism was similarly obtained from the spinal fluid presents the possibility that the pigmentary

disturbance was of central origin in the uveitis in this syndrome and in sympathetic ophthalmia is striking.

The clinical resemblance between the *Gorgas Hospital*.

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BILATERAL UVEITIS WITH RETINAL DETACHMENT, POLIOSIS, ALOPECIA, AND DYSACOUSIA

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On May 22, 1944, Mrs. I. S., 42 years old, white, a resident of New York City, presented herself with the complaint of difficulty in reading small print. She had never used glasses; her general health was good, she stated, except for a recent allergic dermatitis of the lids, due to cosmetics, which her dermatologist was treating.

Examination was entirely negative except for a few cells in the aqueous of each eye, more in the left. Vision O.D. was 20/25 improved to 20/20 with +0.25D. sph. \approx +0.50D. cyl. ax. 90°; O.S. 20/30 improved to 20/20— by +0.50D. sph. The patient read the smallest print by the addition of +1.25D. sph. to each lens. However, the few cells in each anterior chamber as seen with the slitlamp could not be explained, inasmuch as both eyes were white, there was no photophobia, and no ocular complaints other than the difficulty with near vision. The intraocular pressure in each eye was 18 mm. Hg (Schiøtz).

The patient was put on 1-percent parendrine thrice daily, so as not to interfere with her accommodation and thus allow her to continue with her work as a secretary. When she was seen again, four days later, the cells in the aqueous had not increased, the vision was the same, but the fundi now showed an unusual picture. Both optic discs were hyperemic, the margins were fuzzy, and the lower half of each retina was quite yellowish. On the following day, the patient noticed "a big black spot" in front of each eye, and it was found that there was a central scotoma for colors in the right eye and an absolute central scotoma for colors and form in the left eye. The vision was

O.D. 20/30 with +1.25D. sph. and O.S. 20/50 with +2.50D. sph.; the hyperopia had increased. There was still no anterior injection nor change in the cell content of the aqueous. The fundus picture was changing, however, and edema was present at both maculas.

Dr. Brandon found moderate involvement of the antra, and it was decided to have these opened. On May 30th, the day the patient was admitted to Manhattan Eye, Ear, and Throat Hospital, her vision was O.D. 20/60 with +3.50D. sph. and O.S. 20/60 with +5.00D. sph. She had been using atropine for the past week, and the pupils were well dilated. The edema of the retinas had advanced, causing an increase in total hyperopia of 3 diopters O.D. and 4½ diopters O.S.

On June 5, 1944, five-days after the sinuses were opened, the visual loss and retinal edema had progressed, so that now a +5.00D. sph. was necessary for the right eye and +8.00D. sph. for the left eye to obtain 20/60 vision. Now, for the first time fine deposits were seen on Descemet's membrane with an increase of cellular contents in the aqueous of each eye. The margins of both discs were obscured, and the retinas were edematous and yellow; they bulged forward, so that one had the impression of looking into a funnel with the optic disc at the narrow end.

The patient was admitted with a tentative diagnosis of Vogt-Koyanagi syndrome to the Eye Service at Mt. Sinai Hospital, where thorough laboratory investigations could be carried out. When she was admitted on June 14, 1944, the findings were as follows:

Vision O.D. 5/200—, with +4.00D. sph., 20/70; O.S. 2/200, with +7.00D.

sph., 20/100—1. Hypotony was present in each eye. In the right eye were found slight ciliary injection, conjunctival hyperemia, many fine pigmented keratitic precipitates, 4 plus flare, numerous formed elements in the aqueous, pupil dilated and fixed (atropine). The pupillary margin of the iris presented numerous fine fibrinous posterior synechiae, and there were two small Koeppe nodules at the 3-o'clock position. The lens capsule was covered with a very fine dusting of fibrin and pigment particles, the lens showing only rare cortical spoking. The anterior vitreous showed many small colorless opacities. The fundus presented a marked vitreous haze and pronounced retinal edema. The left eye showed similar changes with more precipitates.

The history elicited on admission revealed that the patient had noted photophobia three months ago. For the past three weeks she had had a gradual loss of visual acuity of both eyes with rather frequent headaches. For the past few days visual difficulty in the upper fields was noted, with slight impairment of hearing.

Course. Several days after admission a symmetric bullous detachment of both retinas inferiorly was noted, but no tear was observed. A lumbar puncture after admission showed 725 lymphocytes, with a total protein of 74 and a negative culture. At no time did the patient show meningeal nor any other neurologic signs. During her stay the spinal fluid gradually cleared of cells. Loss of hair and some loss of hearing also became apparent. The eyes showed little change except for increased haziness of the vitreous and decreased vision. However, for the last week of her stay there seemed to be some improvement despite a few days of exacerbation of symptoms. The patient had moderate ocular pain, malaise, and some fever. Both spinal fluid and aqueous

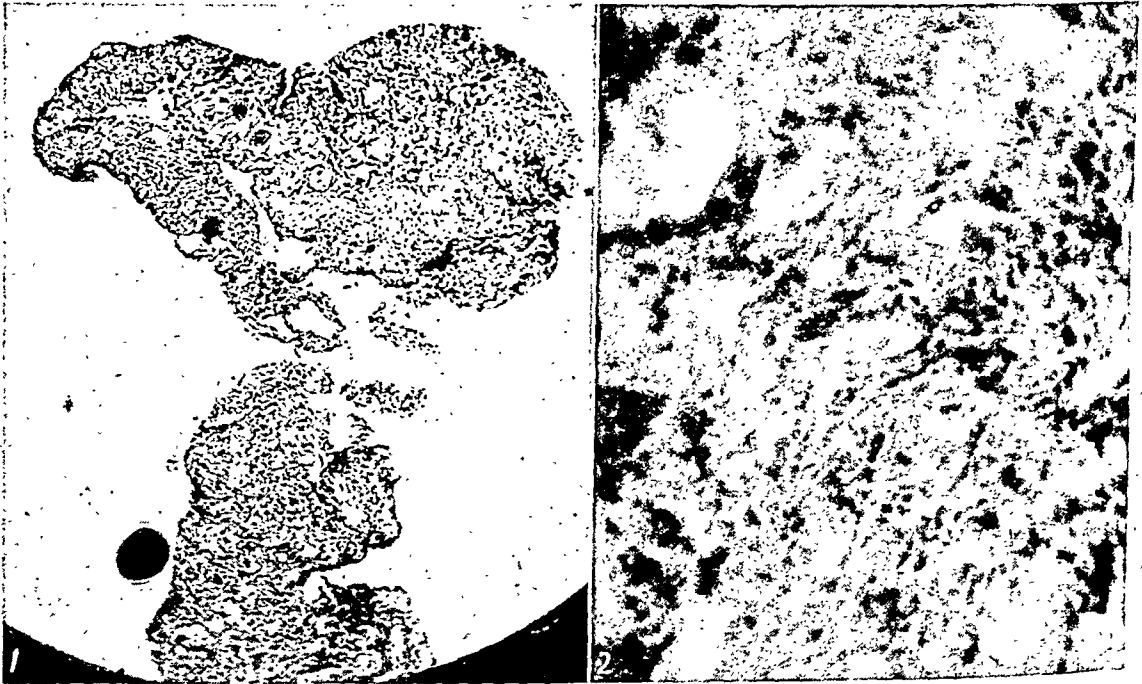
were taken for virus studies and animal inoculations, the results of which are described by Dr. Lubkin as follows:

The procedure used was the inoculation of a mixture of 0.1 c.c. of aqueous with 0.5 c.c. of spinal fluid into the anterior chamber of a rabbit and two guinea pigs, the bathing of the scarified corneas of two mice (white) with the same mixture, and the injection of aqueous alone into the anterior chamber of one rabbit. All were done bilaterally. The amounts injected were 0.05 c.c. into the rabbits (each eye), 0.01 c.c. into the guinea pigs.

All animals were autopsied. One rabbit died within four days of a febrile illness. The others died within the following month (or were killed) without any suggestive ocular or meningitic symptoms or autoptic findings, with the exception of one eye of one mouse. The apex of the cornea became cloudy centrally and remained so for three weeks due to a deep keratitis with exudate in moderate amount in the anterior chamber and some iritis. The exudate consisted of fibrin, lymphocytes, and a goodly number of polymorphonuclear lymphocytes. There was likewise mixed cells in the adjacent cornea, which was slightly edematous. Nothing suggestive of inclusion bodies was observed even in the Giemsa-stained slides. The epithelium of the cornea seemed to have regrown in this region. The animal was otherwise asymptomatic. The impression was that the animal's keratitis was based upon secondary infection and that the entire series was negative. Dr. Schwartzman received specimens of aqueous and spinal fluid for virus studies and reported them as all negative. Cultures of the spinal fluid were negative; the serum showed no agglutinins against *Brucella abortus* and *melitensis*. The electron microscopy of the aqueous and spinal fluid showed no viruslike bodies.

Treatment. During the patient's stay at Mt. Sinai Hospital, the therapy was as follows: A full course of penicillin, 700,000 units over five days, was given. Four courses of maintained intravenous typhoid-fever therapy were administered, temperatures above 104°F. being maintained for at least four hours after each injection. Local treatment for the iritis and attention to foci of infection includ-

alopecia and grayness of the few hairs left on her scalp. There was no vitiligo and none was found at any time by Dr. Behrman even with the ultraviolet light, using Wood's method. The left globe was slightly injected, the pupils were irregularly dilated and adherent to the lens capsules, much pigment debris was on the capsules with many deposits on Descemet's membrane, and there was a cellular



Figs. 1 and 2 (Laval). Excised iridic tissue from a case of Vogt-Koyanagi syndrome. The tissue is extremely necrotic so that it is quite friable and stains very poorly. There is a moderate amount of round-cell infiltration with an occasional plasma cell. Some hyaline degeneration is present, but there is no thickening of the vessel walls. No tubercles, giant cells, nor inclusion bodies are present.

ing the sinuses were continued. However, there seemed to be no definite response to any of these, and it was felt that the patient would have to sustain the natural course of the disease.

On August 18, 1944, the tension was 40 mm. Hg (Schiøtz) in each eye; the vision was O.D. 20/200, O.S. 20/400, not improved by glasses. There was moderate poliosis of the lashes of each upper lid, the eyebrows were entirely gone, with marked

aqueous. The fundi were visualized with some difficulty, but one could observe that the areas of detachments below were quite flat and the retinal tissues here were washed out and thinned. A blood transfusion of one pint was given on August 30th.

On September 1st the tension was O.D. 43 and O.S. 50 mm. Hg. On September 8th a modified Lagrange operation with complete iridectomy was performed on

the left eye at Manhattan Eye, Ear, and Throat Hospital; the histologic description of the excised iris is given in figures 1 and 2.

There was surprisingly little reaction to the operation, with only a small hyphaema which was absorbed rather quickly. Twelve days postoperatively the tension was O.S. 18 and O.D. 35 mm. Hg. The vision was O.D. 20/50 with $-1.00D.$ sph. (no more plus lenses were necessary now that the retinal edema had subsided) and O.S. 20/400 not improved. The patient was given atropine daily for the left eye, no drops for the right. On October 3d another pint of whole blood was given by transfusion. On October 12th the tension was O.D. 55 and O.S. 15 mm. Hg. Pilocarpin 2 percent was given every two hours for the right eye, but the tension did not fall below 45 mm. Hg.

On November 9th a modified Lagrange with complete iridectomy was performed on the right eye, and there was no post-operative reaction at all. The iris tissue that was excised was similar to that obtained from the left eye. Due to allergic dermatitis from the atropine, scopolamine was ordered for both eyes and the tension continued at 15 mm. Hg, O.U. The patient gradually became allergic to scopolamine and 10-percent neosynephrin was given to be used once daily. By December 19th the vision was O.D. 20/50 with $-1.00D.$ sph., and 20/200 O.S. with $-0.75D.$ sph. The cells in the aqueous were diminishing, and the deposits were fewer. The fundi could be seen quite clearly and the reattached retinas were pale yellowish pink with irregular pigment mottlings. On February 7, 1945, the vision was O.D. 20/40 and O.S. 20/100; on May 10, 1945, it was O.D. 20/30—1 with $-1.75D.$ sph., and 20/100 O.S. with $-0.75D.$ sph. The patient read Jaeger 3 with a $+3.25D.$ sph. add O.U. The eyebrows were slow in growing back, but

the hair on the scalp had improved remarkably in color as well as in amount. The lashes were quite black again.

COMMENT

There have been many reports of uveitis associated with poliosis, dysacusia, alopecia, and vitiligo. Another report would have nothing to recommend itself except in so far as some new observations could be added. In this particular report there are at least two contributions of interest, one clinical, the other pathologic. The clinical observation is unusual in that the patient was seen so early in the course of the disease that the only abnormal finding was a few cells in the aqueous. The pathologic contribution consists of a study of the iris tissue of each eye of the patient. A possible third point of interest is the spinal-fluid findings and the studies made on the aqueous of one of the diseased eyes. This has been done before, but so infrequently that I believe only four other investigators have reported spinal-fluid examinations and only two others aqueous examinations.

Vogt was the first to call attention to the syndrome, but Koyanagi was preceded by several others. It is true that Koyanagi added dysacusia and alopecia, but the condition had been recognized and treated for some time before Koyanagi's paper appeared. One should not ignore the work of Gilbert, Elschning, Erdmann, and Komoto. So-called Harada's disease is the same condition without involvement of the anterior uvea. And one should remember that not all cases have all the factors of the syndrome; one or more may be missing but still the diagnosis is made.

In 1910, Gilbert, in discussing his case, suggested that a herpetic lesion might be the causative agent. Investigators today are still looking for a virus as the possible etiologic factor. In 1911, both Komoto

and Erdmann supported Gilbert's theory when they discussed their own cases. In 1929, when Koyanagi presented his paper, he could add nothing to the etiology or the pathology, but he did add two additional signs to the syndrome; namely, alopecia and dysacusia, which may occur in some of the patients. In 1930, Takahashi carried out some animal experiments and came to the conclusion that a virus was responsible, a concept possibly similar to that entertained for sympathetic ophthalmia or herpetic lesions; again no further advanced than Gilbert's concept in 1910. In 1939, Magitot and Dubois-Poulson had a case in which there were cells in the spinal fluid and "thought" it was due to a virus. In four of Takahashi's six cases the spinal fluids were positive; that is, they contained cells. Malbran and Muhlmann thought their case of Harada's disease was due to a "neurotropic virus" similar to the causative agent of herpes or sympathetic ophthalmia. In Salus's case grayish nodules were present in the iris, and he performed an iridectomy to relieve increased intraocular pressure, but he does not report an examination of the excised iridic tissue. Givner did report on the excised iris tissue and found evidence of chronic inflammation with an occasional eosinophile. Wexler's case was unique in that the vitiligo developed in a

Negress and was quite extensive, but there was no complete laboratory examination.

The two recent attempts to isolate a virus, by Givner and by Hague, both proved to be fruitless as did the attempt in my case. I agree with Hague that the answer lies in the fact that we take the material from the patients too late in the course of the disease. In my case, the aqueous should have been used as soon as the retina began to look edematous, at least six weeks before it actually was used, and the same holds true for the spinal fluid. Hague's and Rosen's recent reports were all-inclusive and remarkable examples of thorough and painstaking clinical effort and literary research.

Inasmuch as the iris tissue shows no lesion characteristic of any particular type of infection, nor any evidence of local virus infection as we understand it today, we must admit that we are no further advanced in our understanding of this disease entity than we were 35 years ago. I doubt that pathologic examinations of an entire globe will throw any further light on the etiologic factor. The future advances lie in better and earlier methods of utilization of the pathologic fluids and tissues obtained from patients with this disease entity.

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THE INFLUENCE OF VEHICLES AND FORM OF PENICILLIN AND SULFONAMIDES ON MITOSIS AND HEALING OF CORNEAL BURNS*

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The extensive use of locally applied sulfonamides and penicillin on wounds has stimulated investigation of the effect of these compounds on the regenerative capacity of the injured tissues.¹⁻⁴ In a previous communication,³ it was shown that although chemotherapeutic agents did inhibit the regeneration of corneal epithelium following burns and abrasions, some compounds (sulfadiazine and penicillin) caused practically no inhibition of the healing processes when applied in therapeutically useful concentrations. This conclusion was qualified by the form and vehicle in which the compound was administered; that is, powder, solution, or ointment. It was noted, for example, that sulfonamide powders were more detrimental to healing than lanolin-base ointments of the same compound. It appeared that the size of the particles of these powders might be an important factor contributing to the delay in healing. In addition, our earlier experiments showed that the frequent application of aqueous penicillin solutions (500 Ox.U./c.c.) to the abraded or burned cornea did not inhibit regeneration of the epithelium. Leopold and La Motte,⁴ investigating the effect of penicillin solutions on the abraded rabbit cornea, came to the same conclusion. These authors demonstrated that the application of penicillin ointments, 500 Ox.U./gm. in carbowax base, produced a satisfactory concentration of this drug in the aqueous humor; however, no obser-

vations were made on the effect of penicillin ointments on regeneration. The use of penicillin ointments is becoming very extensive, and since it has been shown (Leopold,⁴ Bellows⁵) that they produce a high concentration of the drug in the anterior portion of the eye, experiments were undertaken to determine the influence of penicillin, in ointment and also powder form, on the ability of epithelial cells to divide and migrate following extensive corneal burns.

The present communication, therefore, deals with the evaluation of: 1. several ointment and powder bases relative to their effect on healing; 2. the role of particle size of sulfonamide powders in the inhibitory effect these compounds have on wound healing; and 3. the effect of penicillin ointments and powders on the healing of corneal burns.

The influence of these drugs and vehicles was determined on both of the major processes involved in the healing of epithelial injuries, cell division, and migration. It has been shown that cell division is active during the period of cell migration following thermal burns.³ The methods used were essentially the same as those reported earlier. Thermal burns of both corneas of rats were produced by the application of a Shahan thermophore (71°C. for 5 seconds). The terminal of the thermophore was shaped to fit the rat's cornea. The burn produced was a 1.5-mm. band extending horizontally

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The work described in this paper was done under a contract, recommended by the Committee on Medical Research, between the Office of Scientific Research and Development and Columbia University.

from limbus to limbus. Bowman's membrane was left intact, but the epithelium was killed and sloughed away under the action of tears and lids in two to three hours. Normal healing was rapid, the defect being nearly covered in 12 hours and completely covered with epithelium in 15 hours. If both eyes were left untreated it was found that the injuries healed at an equal rate.

The average residual area of the right and left eye of the control burns varied only 7 percent, 12 hours after the injury was made. The material to be tested was applied to one eye once every two hours. The powders were applied generously and evenly so that the entire cornea was covered. Some residual powder was found in the lower conjunctival sac two hours after such an application. The ointments were also applied in excess, and the animal held for one minute after each application to permit the material to reach all parts of the conjunctival sac. In those experiments where the effect of a drug incorporated in a base was to be tested, the other eye was treated with the ointment base alone. Male rats of the Sherman strain, six weeks of age, and weighing 80-100 gm. were used. The operations were performed in the morning, and the eyes treated throughout the day. Twelve hours after the burn had been made the rats were autopsied and the eyes fixed for histologic study. Accurate camera-lucida drawings of the extent of the unhealed portion of the burn were made at this time and their area was determined by planimeter measurements of the drawings. The eyes were then sectioned, and the mitotic figures in the epithelium were counted. The number of figures in the treated and control corneas were compared, and the difference expressed in percent of the control eye. The number of mitotic figures found in bilateral untreated burns did not differ significantly

in any of 12 cases studied, and the average of the group was only 0.8 percent. The mitotic-figure counts in the powder experiments were made from flat whole mounts of the cornea stained with Harris's hematoxylin. The fixative and stain were used as recommended by Buschke, Friedenwald, and Fleischmann.⁶ After fixation, the corneas were dehydrated, stained, and mounted in Diaphane. The cedarwood oil step and mounting medium used by these authors were omitted; the counts were made in two to three strips extending across the entire width of the cornea and bisecting the band-shaped burn at right angles. The width of the strip of epithelium counted was outlined by an Ehrlich stop, aperture 4 mm. placed in the $\times 10$ eye piece. A $\times 43$ objective was used.

EXPERIMENTAL

The effect of particle size of three sulfonamides on epithelial regeneration was studied. The standard thermal burns were made on both eyes of a series of 32 rats, and sulfonamide powders were applied as aforescribed, a very fine powder (<325 mesh) to one eye and a coarser (100-200 mesh) to the other. The coarser powders were the same size as those used in previous studies.³ The fine sulfathiazole and sulfadiazine powders were the "microcrystals" of those drugs, and the fine sulfacetimide powder was obtained by grinding in a mortar.*

The previously reported inhibition of healing by sulfonamide powders was confirmed, but with sulfathiazole and sulfacetimide this inhibition was definitely less when fine powders were used (fig. 1). The results were very consistent, and favorable in 8 of the 10 pairs of burns

* Our thanks are due to Dr. E. Henderson and Schering and Company for the generous supply of sulfacetimide used in these experiments.

treated with the fine powder of each drug. The average unhealed area of burns treated with the coarser powders was 42 percent and 73 percent greater than in the burns treated with very fine powders of sulfacetamide and sulfathiazole, respectively.

Contrary results were obtained with sulfadiazine, for in these experiments the burns treated with the fine powders healed

burns was treated with fine powders of substances which were presumably non-toxic compounds. Calcium carbonate, zinc oxide, and lactose powders of particle size <325 mesh were used. They are relatively insoluble so that the osmotic pressure of the tears would not be greatly increased. In these experiments the powder was applied to one eye and the other left as an untreated control. All of these

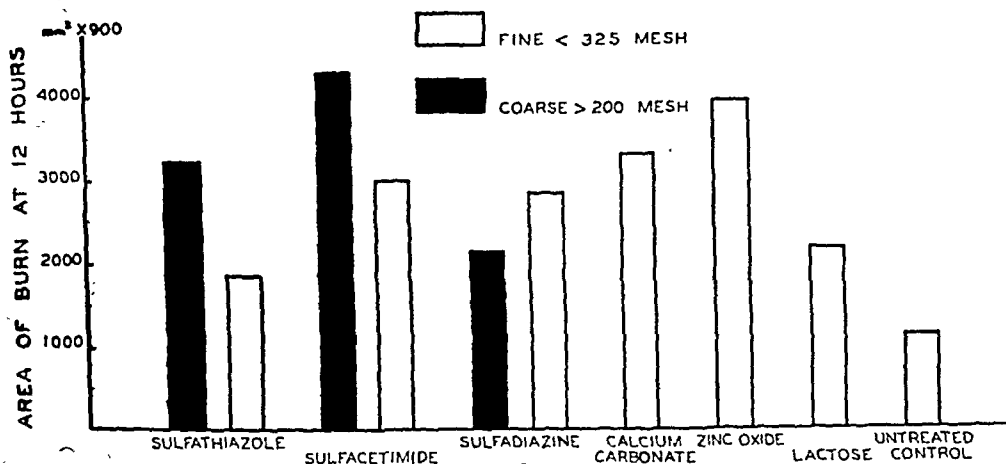


Fig. 1 (Smelser). The area, in sq. mm. $\times 900$, of the unhealed portion of standard thermal burns treated with fine and coarse powders of sulfonamides and control substances. The fine and coarse sulfonamide powders were applied to the right and left eyes, respectively. The calcium carbonate, zinc oxide, and lactose powders were applied to the right eye of each animal, the left eye was the untreated control burn. Each column represents the average based on 10 or 11 experiments for each sulfonamide; 5 to 7 rats were used with each of the inert powders and 18 for the control burns.

at a somewhat slower rate than did those receiving the coarser material. The difference in the healing of the coarse- and fine-powdered burns was not so great (-27 percent) as was found with the other drugs, and the difference was not statistically significant.

It is obvious that at least two major factors are involved in the delay to healing caused by these powders. One may be chemical and due to the nature of the compound itself, and another the mechanical factor of solid particles eroding the thin, freshly regenerated epithelium.

In order to determine the effect of the mechanical factor of particles, a series of

powders delayed epithelization (fig. 1); zinc oxide and calcium carbonate caused the most retardation. Lactose was the least harmful, having an inhibitory effect comparable with petrolatum. Calcium carbonate delayed healing to about the same degree as did finely powdered sulfacetimide, and the delay caused by sulfathiazole and sulfadiazine was comparable to that caused by lactose. It would therefore appear that the mechanical factors in these sulfonamide-powder applications are the main ones which inhibit healing.

The number of dividing cells in the regenerating epithelium was not affected by the application of lactose, CaCO_3 , or

ZnO powders. The difference in number of mitotic figures seen in the treated and untreated eyes was not greater than that found in a control series of bilateral untreated corneal burns.

These data suggest that sulfonamide ointments containing the drug as a finely divided powder suspension would not greatly delay healing. Ten-percent sulfa-

layed healing slightly less than did sulfathiazole.

OINTMENT BASES

Six ointment bases, suitable for ophthalmic use, were studied in the same manner as were the powders. Each base was tested on 5 to 7 pairs of corneal burns. Hydrosorb* and aquafor were used

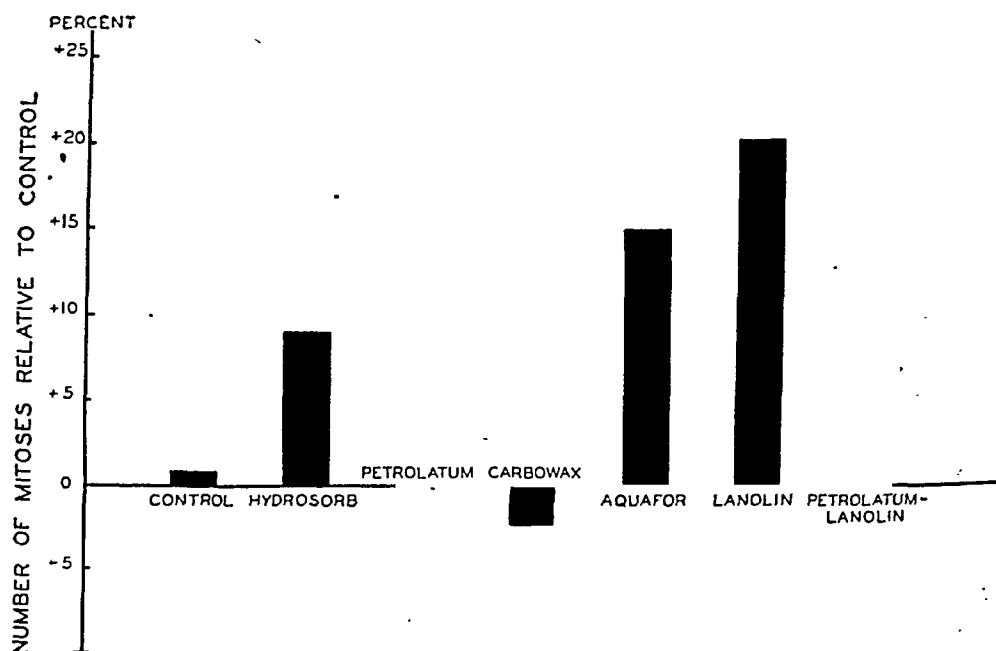


Fig. 2 (Smelser). The number of mitotic figures found in regenerating corneal epithelium treated with various ointment bases, 12 hours after a standard thermal burn. The difference in the number of mitotic figures found in the epithelium of the treated and untreated control eye of the same animal is expressed in percent of the control eye. The control bar shows the difference between the number of mitotic figures found in untreated burns of the right and left eye of the same animal. Each ointment was tested on 5 or 6 animals.

diazine and sulfathiazole ointments were prepared, using "Micraform" crystals (<325 mesh) in hydrosorb base. Bilateral standard thermal burns were made on the corneas of 12 rats. The sulfonamide ointment was applied to one eye and the ointment base to the other every 2 hours for 12 hours. Healing was delayed in both eyes of all animals; however, the delay in the sulfonamide-treated eyes was not much greater than in the eyes treated with the base. Sulfadiazine de-

without the addition of water. Carbowax 1500 was selected because its consistency was suited to ocular application. A hydrous lanolin base was prepared by incorporating one part of a 1.5-percent NaCl solution in three parts anhydrous

* Hydrosorb (Abbott) is a mixture of oleic acid ester and amide of diethanol amine, oleic acid, and white petrolatum. Carbowax compound 1500 (Carbide and Carbon Chemicals Corporation) is a polyethylene glycol. Aquafor (Duke Laboratories, New York City) is a mixture of petrolatum, wool fat, and cholesterol.

lanolin. The petrolatum-lanolin base consisted of 75-percent soft petrolatum, 20-percent anhydrous lanolin, and 5-percent 1.5-percent saline, by weight.

These bases appeared to be well tolerated by the burned eyes of the rats, except carbowax, which seemed to cause some discomfort. The animals made more effort to rid themselves of this material

thelium (fig. 2). There was a very slight average decrease in the number of mitoses seen in petrolatum- and carbowax-treated eyes, but this difference is without significance. The epithelia treated with ointments containing lanolin showed, on the average, more dividing cells than did the controls, but there was considerable variation between the individual animals. The

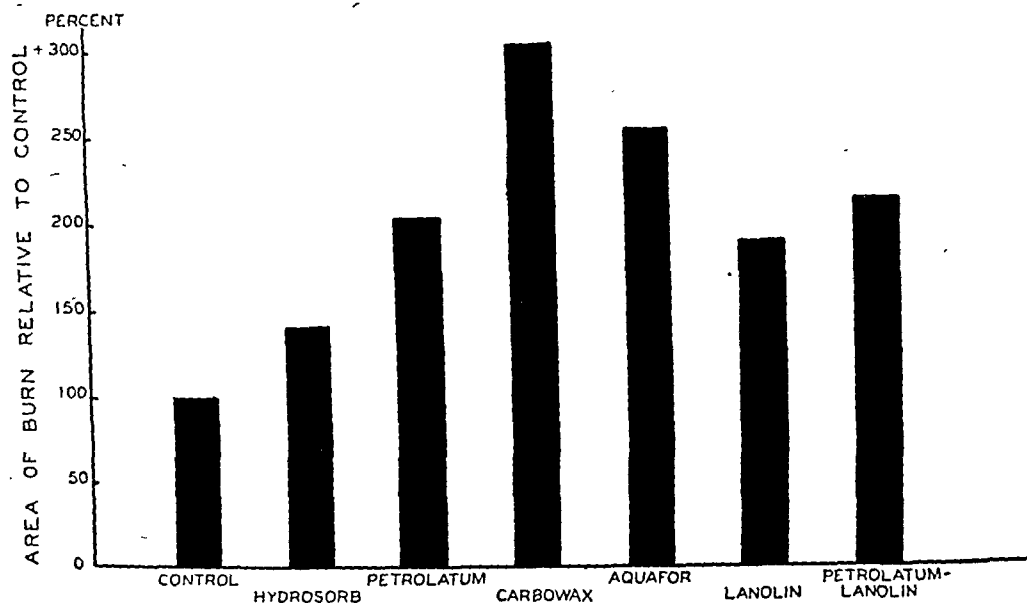


Fig. 3 (Smelser). The effect of various ointment bases on epithelization of corneal burns. The bars represent the unhealed area of the treated burns, 12 hours after the injury, relative to the area of the untreated control burn of the same animal. The area is expressed in percentage of the area of the untreated control burn which is represented by 100. Each bar is the average of 5 or 6 cases.

than of the others. Carbowax differed from the others because of its solubility in tears. An amount of carbowax which covered the eye and filled the conjunctival sacs dissolved in one or two minutes in the tears. It may be that the material itself stimulated tearing. Some difficulty was found in making petrolatum adhere to the ocular epithelia, but this was overcome by softening the petrolatum with the addition of a few drops of mineral oil.

None of the ointment bases interfered with cell division in the regenerating epi-

thelium. The increases found, 20-25 percent, are on the borderline of statistical significance.

All of the ointment bases inhibited epithelization to some extent; however, some were far more harmful than others (fig. 3). Hydrosorb-treated burns healed the most rapidly. Petrolatum, lanolin, and their mixtures were moderately inhibitory; the unhealed portion of the burns treated with these ointments were twice the size of the untreated control burn at the 12-hour stage. Carbowax and aquafor inhibited epithelization the most; the residual burn area of these groups av-

eraged $2\frac{1}{2}$ -3 times that in the control eye. It is obvious upon reference to figures 2 and 3 that epithelization may be delayed in the absence of a decrease in mitosis. It is clear that hydrosorb possesses advantages in both its effect upon cell division and migration. Second choice of ointment material based on these factors would in-

cillin was finely ground in a drop of mineral oil with a glass rod; this fine suspension was thoroughly mixed with soft petrolatum to make the desired concentration. (3) Penicillin, in the free acid form,* was ground in a drop of mineral oil with a glass rod and then incorporated in petrolatum; (4) a preparation similar

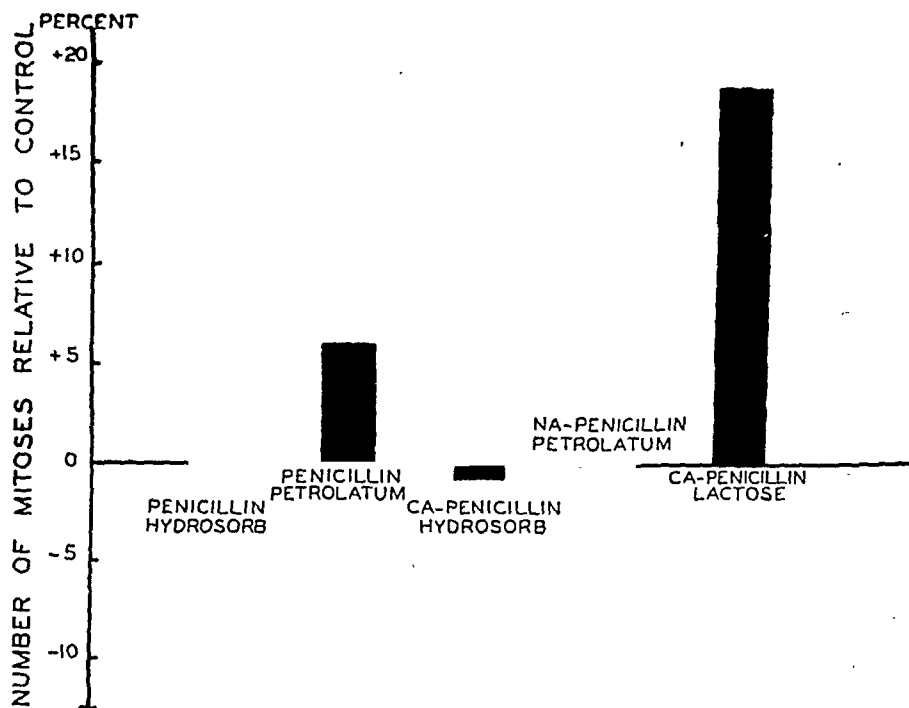


Fig. 4 (Smelser). The effect of penicillin in ointment and powder form on cell division in regenerating corneal epithelium. The number of mitotic figures is expressed in percentage of the number found in the control burn which received the ointment or powder base alone. Each bar is the average of 6 to 8 experiments.

clude lanolin and petrolatum. Carbowax appeared to be the least desirable on this basis. For these reasons, in the experiments with penicillin ointments, hydrosorb and petrolatum bases were used.

EFFECT OF PENICILLIN OINTMENTS AND POWDERS ON HEALING

All of the penicillin ointments were prepared to contain 1,500 Ox.U. per gram. Four preparations were tested. (1) Ca-penicillin (Squibb) was dissolved in one drop of water (ca. 50 mg.), and this made up to 1 gm. with hydrosorb. (2) Na-peni-

to (3) except that hydrosorb was used instead of petrolatum. The first ointment contained the drug in aqueous solution: in the last three the penicillin was dispersed in an anhydrous medium. In two cases soluble salts of penicillin were used, in the others the penicillin was in a lipid soluble form. Ophthalmic penicillin ointments of this type, but in another base, were introduced earlier (Von Sallmann

* We are greatly indebted to Dr. G. A. Harrop and Dr. Oscar Wintersteiner for the preparation and assay of the free acid penicillin used in these experiments.

and Meyer⁷). All ointments were freshly prepared for each experiment. In the present experiments the penicillin-containing ointment was applied to one burned eye, and the ointment base alone to the other. These four ointments were tested on 24 animals.

The effect of penicillin on mitosis in regenerating corneal epithelium was not marked; however, the number of dividing cells in the epithelia treated with acid

burn areas treated with penicillin or the calcium salt was smaller than that of the controls, but the difference was slight and should not be considered as evidence of stimulation. The unhealed area of the burns treated with the Na-salt ointments tended to be greater than in the controls, but this also is without significance.

PENICILLIN POWDERS

These data show that penicillin does

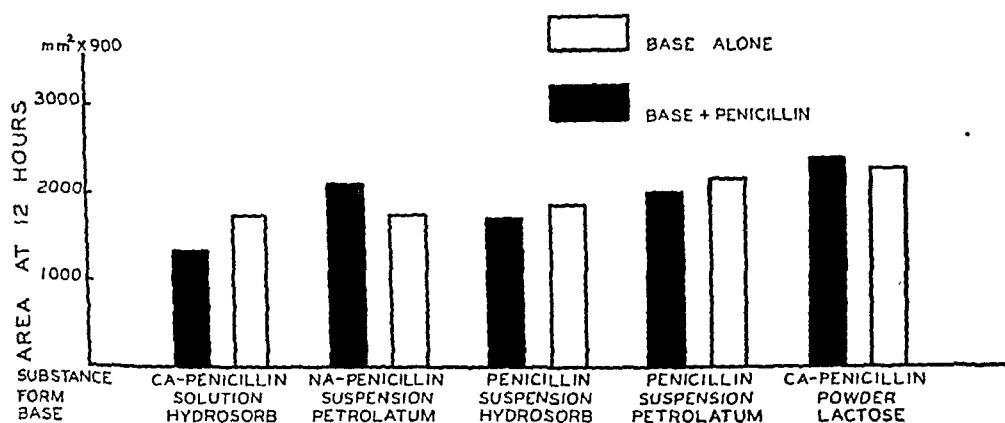


Fig. 5 (Smelser). The area, in sq. mm. $\times 900$, of the unhealed portion of standard burns treated with penicillin ointments and powder. The areas were measured 12 hours after burning. Each preparation was tested on 6 to 8 animals.

penicillin tended to be slightly greater than in the controls (fig. 4). The Ca-penicillin was without effect. Three of the eight animals treated with Na-penicillin showed definitely fewer mitoses in the treated eye. The same ointments were applied to intact corneas of 14 animals once every hour, instead of at two-hour intervals. The frequency of mitotic figures was not significantly disturbed in any, but mitosis counts tended to be low in the Na-penicillin-treated eyes.

The rate of epithelization of burns treated with penicillin was extremely good (fig. 5). The burns treated with ointments of penicillin, or its salts, healed at essentially the same rate as the control burns treated with the ointment base alone. The average 12-hour-

not interfere with the reparative processes when applied as ointments. The use of penicillin in powder form, to insure very high local concentration, has been suggested⁵ and used clinically.^{8, 9} Therefore, penicillin powder was applied directly to corneal burns. Both eyes of 14 rats were burned, and one eye in each case received a small amount (about 0.5 mg.) of penicillin powder every 2 hours for 12 hours. Eight rats were treated with Na-penicillin and six with the calcium salt. The powder dissolved in the surface film before the animals were released, so that there was no abrasive action of the powder on the regenerating epithelium. The results were extremely bad. The wounds did not heal; in fact, often a larger area of the cornea was denuded at the end of

the 12-hour period than was caused by the burn. No mitotic-figure counts were attempted. The penicillin powders were then applied to the intact corneal epithelium of six animals. In five of these there was definite destruction of the corneal epithelium. The corneas stained strongly with fluorescein, and sections showed that they had been extensively eroded down to Bowman's membrane. Mitotic-figure counts were made in one case in which the erosion was only superficial. The number of cell divisions was normal.

Obviously the use of penicillin powder undiluted is contraindicated. Ca-penicillin powder was thoroughly mixed with lactose (particle size <325 mesh) and the mixture made homogeneous by repeated sieving. Calcium penicillin was chosen because it is not so hygroscopic as the sodium salt, and the preparation available was a very fine powder. Each gram of lactose-penicillin mixture contained 30 mg. of Ca-penicillin or 28,000 Ox.U. penicillin per gram. The lactose-penicillin powder was applied to corneal burns of six animals. The control burns of the same animals were treated with lactose alone. The treatments were at 2-hour intervals, and the powders were applied over the entire cornea. The results (fig. 5) show that the penicillin-lactose powder did not delay epithelization more than did the lactose alone. Furthermore, the use of the very strong powders did not delay healing more than the application of such materials as petrolatum or lanolin.

The number of mitotic figures in these treated burns was also determined (fig. 4). The penicillin-treated eyes tended to have more cells in division than did the control eyes, but the difference was slight. Only one case showed definitely a greater number of mitotic figures in the treated epithelium.

DISCUSSION

In determining the effect of therapeutic agents upon healing, many factors are involved. The accepted beneficial effect of the agent may be in part or entirely voided by damage inadvertently done to the healthy regenerating tissue. The damage may be caused either by the method of administering the drug or by secondary effects of the compound itself. Harm caused by physical factors in the method of administration can be avoided by changes in technique. Inhibition due to the drug itself can be avoided only by substituting another compound or by decreasing concentration or the speed with which the drug is released to the tissues.

The importance of physical factors is illustrated by the effect that particle size of sulfonamide powders had on epithelization of corneal burns. It seems likely that such physical factors are of particular importance in the eye. The action of the lids moving the particulate matter over the intact and actively regenerating epithelium would cause, as has been shown, considerable damage. The inhibition of healing caused by the large particles suggests that powders incorporated in ointment bases should also be very minute. The mechanism by which the coarser powders inhibited healing is not clear. They may erode the epithelium partly with the aid of lid action or they may actually block the forward movement of the cells over the denuded area. This latter does not seem probable, for the finest powders would do this as well. If actual erosion or the formation of minute injuries is involved, probably the shape of the particles would play a role. Another factor is the stimulation of tearing; the tears themselves may influence the processes of healing.

The physical and mechanical factors were obviously not the only ones involved in the inhibition of healing in these ex-

periments. Even though sulfacetimide was applied as a very fine powder it still delayed healing more than the other sulfonamides; likewise, zinc oxide was more detrimental than lactose. These differences may be due simply to the solubility of the compounds and the production of hypertonic media, or to some chemical action on the cellular metabolism.

The selection of suitable ointment bases for ophthalmic use is complicated by the many factors which must be considered. Obviously, the preparation must adhere well, hold the drug without destruction of its activity, and release it to the tissues in effective concentration. The effect of the base on wound healing is an additional factor. In the present experiments it is shown that some ointments delay healing much more than others, but all bases tested delayed healing to some extent. Without a single exception, every burn treated with any ointment base was at least a little larger than the untreated burn of the control eye at the 12-hour stage. In the case of hydrosorb and lanolin the mean difference between the treated and control eyes was not great; in fact, statistically insignificant. The presence or absence of water in the base does not seem to be of great importance, for the lanolin ointment was one-fourth water, and the hydrosorb anhydrous. The means by which ointment bases inhibit healing is not indicated by the present experiments. It is difficult to imagine that they physically block the movement of the cells, for no more than a surface film remained on the eye for any great length of time. Carbowax, which delayed healing the most, dissolved in the tears and appeared to be removed almost completely between applications. The solution of this base may have caused an unfavorable shift in the osmotic pressure of the fluids on the

cornea. It does not seem likely that these varied bases were or contained substances toxic to the epithelium. It is also difficult to believe that they formed a film over the cells which would inhibit gaseous metabolism. The bases conceivably could absorb substances necessary to the healing processes and thus carry them away; however, there are no available data bearing on these hypotheses.

From a practical point of view it is clear that ointment bases alone may delay healing, but that some are less harmful than others. This observation is in agreement with the report of Leopold and Steele.¹⁰ Therefore, a base should be selected from this group provided that it satisfies the other requirements outlined above.

The experiments with penicillin ointments confirm the result of our first series, that penicillin, in this form, was almost completely harmless to the reparative processes of the corneal epithelium. Application of the very strong ointments caused no detectable inhibition in the repair processes of either mitosis or cell migration other than that due to the ointment base. No real difference, in this respect, was found between the several ointments tested. This is in agreement with the clinical observations of Crawford and King,¹¹ who, however, used much weaker penicillin ointments. The decrease in number of mitotic figures found in the epithelium treated with the sodium-salt ointments, although suggestive, was too slight to be regarded as significant; however, it should be pointed out that this preparation slightly delayed epithelization also.

Although penicillin in ointments did not significantly delay healing in these experiments, the application of penicillin in other forms may cause marked harm to the corneal epithelium. The intact cor-

nea cannot tolerate even minute quantities of penicillin powder applied directly. Owing to the solubility of these powders it seems certain that the damage is not caused mechanically. The effect of such local application of penicillin to healing burns was disastrous, for the epithelium not only failed to heal but some of the unburned portion was sloughed away. Again the effect could not have been due to mechanical action of the particles. Use of penicillin powders in this manner is definitely contraindicated. Anhydrous penicillin powders, however, may be applied if the penicillin is sufficiently diluted, as was shown in the experiments with lactose-penicillin powders. The use of powders has the advantage that the penicillin is almost instantly dissolved and an aqueous film of very concentrated penicillin solution covers the epithelium. This film is held for some time by the lactose particles which are permeated by the penicillin solution, and may act as an infinite number of minute lamellas.

SUMMARY

1. The size of the particles of sulfonamide powders applied to injured corneal epithelium is an important factor in the delay they cause in healing.

2. Powders with particle size < 325 mesh inhibit healing the least. When the particle size is 100-200 mesh, marked inhibition results.

3. Sulfadiazine and sulfathiazole powders inhibit the healing of corneal burns

less than does sulfacetimide powder.

4. Sulfadiazine and sulfathiazole powders do not inhibit healing more than presumably inert powders such as ZnO or CaCO_3 .

5. Finely powdered lactose inhibited healing less than any other powder tested, and hence is suggested as a vehicle or diluent.

6. Ointment bases varied in the degree with which they inhibited the healing of corneal burns. Hydrosorb and lanolin were the least harmful.

7. Application of penicillin ointments (1,500 Ox.U./gm.) did not retard epithelization or mitosis in corneal burns more than the ointment bases alone. This was true of both hydrous and anhydrous ointments, particle suspension and solution types, as well as ointments prepared with the free acid of penicillin or its calcium salt. Very slightly less desirable results were obtained with a Na-penicillin-powder suspension ointment.

8. Solid penicillin (Ca or Na salts) applied in minute amounts markedly harms both normal and burned corneal epithelium, completely preventing the healing of corneal burns.

9. Ca-penicillin powder, suitably diluted with lactose (28,000 Ox.U./gm.), may be applied to corneal burns without inhibiting healing more than would the lactose or petrolatum alone.

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OVERSEAS OPHTHALMOLOGY

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How will the practice of ophthalmology in an overseas theater differ from a civilian practice? While perusing case records collected over a 10-month period in 1944, I found bits of information that might be of interest to those who had not been sent overseas. It seemed worthwhile to report this information and to discuss the problems and trends of ophthalmology as I observed them in New Guinea.

Data for this report were gathered from outpatient and hospital services among general, station, and field hospitals in both combat and rear areas. The patients represented all branches of the armed services but were predominantly members of the Army Air Corps and Army ground forces. Approximately 2,400 individuals registered for the first time in the eye departments of these hospitals during the 10-month period. For convenience of discussion the subject matter was divided into six sections; namely, refractions and ocular-muscle problems; so-called diseases of the external eye; ocular conditions produced by trauma; neurologic and medical problems associated with the eyes; surgical procedures; and equipment and supplies.

REFRACTIONS AND OCULAR-MUSCLE PROBLEMS

The majority of the patients, some 1,450 (60 percent of the total), were registered in the refraction department because of complaints referable to an alteration of visual acuity or because of headaches. The diminution or blurring of vision was associated either with reading, working in the sun, attending movies, syncope, or dizziness. Such symptoms were similar to those met with in civilian practice except for the frequent implication of the tropic sunlight. Each patient was given a complete ocular examination, and some type of refraction was performed.

In only half of the cases was there found a refractive error of such degree as to warrant a prescription for glasses. These individuals presented the familiar symptoms of eye fatigue associated with attending movies or doing close work and usually obtained relief by the wearing of correcting lenses. An exception was encountered among radar operators of air-warning units. These individuals usually worked six-to-eight-hour shifts daily, oftentimes at night. From the description

of their work in addition to the intensity of their ocular symptoms it appeared that this occupation was unusually fatiguing to the eyes. Most of the radar operators had a visual acuity of 20/20 and a refractive error under cycloplegia of less than one diopter in any meridian. Prescribing of glasses did not always bring relief of symptoms. In general, the types of refractive errors among the group to whom glasses were issued were similar to those encountered in civilian practice.

In the 50 percent to whom glasses were not issued, an ocular basis for their complaints was not found. These individuals associated their eye complaints either with dizzy spells, bizarre headaches, or outdoor work in the heat. A history of eye difficulties prior to their service in this area was not often obtained. Many of these soldiers had visited clinics in other hospitals without obtaining relief of their symptoms. In all cases the symptomatology did not seem sufficiently marked nor incapacitating to warrant evacuation from an overseas theater. Their repeated attendance at sick call created quite a problem for the unit medical officer. Most of the patients were dissatisfied that an organic basis for their difficulties was not found.

Many soldiers complained of photosensitivity not associated with dizziness, headache, fainting, or other psychoneuroticlike symptoms. Special attention was given to this complaint because the individual felt incapacitated for outdoor work. With the instruments available, alterations in the corneas and lenses were not seen. Alteration of the pigment content of the maculas was not observed. This symptom seemed equally as frequent in blonds and brunets. Sunglasses of good quality were so scarce that a therapeutic trial was not always possible except in Air Corps personnel. I felt that the efficiency of many ground-force person-

nel would have been improved if a larger supply of sunglasses had been available. In the absence of definite ocular pathologic change one could only assume that the photosensitivity was, in a sense, a physiologic response of the eyes to tropical sunlight.

Flying personnel of the Air Corps were infrequent visitors to the refracting room, although a large number of such personnel were present in this area during the period of this study. The low incidence of visual-acuity complaints among this group speaks well for the screening methods employed in the United States. When such personnel did report with eye complaints, their refractive error, heterophoria, and accommodative and convergence relationships were found to be within the limits of normal. The flight surgeon usually felt that such individuals were suffering from combat and flying fatigue.

Only a few cases of abnormal heterophoria were encountered. These were managed by prescribing appropriate prisms, as was customary in civilian practice. Soldiers seemed more tolerant of prisms than civilians with similar muscle imbalances.

On an average of twice a month a case of subnormal accommodation with or without convergence weakness was encountered. In all of these, difficulty with close work had occurred since the subject's arrival overseas. None had had any other illness. Repeated examinations always revealed a remote near point of accommodation; the near point often approaching that of a presbyopic individual. I was unable to find an etiology. Plus spherical corrections were added to the refractive error as revealed by cycloplegia, and most of the patients obtained symptomatic relief by wearing the spectacles for near work. In some cases simple convergence exercises were recom-

mended, but the soldiers would not persist in such exercises.

Soldiers with nontraumatic, long existent strabismus were frequent visitors to the eye clinics. Because of limited finances the strabismus had not been corrected in civilian life. The soldiers believed that the strabismus could be easily corrected by the Army "docs" and, in addition, would entail no financial outlay. Early in my overseas service I saw about 10 men with strabismus who had been operated on by Army surgeons. All of these individuals presented excellent cosmetic results, but they were disappointed either because there was no improvement in visual acuity or because of onset of diplopia. The diplopia made them of little use to the Army. Those with diplopia knew that if they made enough fuss about their "double vision" they would be returned to the United States. Those in whom visual acuity had not improved had had poor vision prior to surgery. Subsequently, I became cautious about advising surgical correction for a strabismus that had existed prior to Army service. It seemed that proper preoperative selection of these cases had not been seriously considered. However, there was an occasional need for such surgery among personnel with marked comitant strabismus employed as instructors, and personnel with an alternating strabismus who did skilled work. Such individuals were usually non commissioned officers who occupied responsible positions. The few patients whom I selected for surgery were given careful explanations of the probable functional as well as cosmetic result. When they were returned to duty they not only appreciated the improved cosmetic effects but were also cognizant of the limitations to perfect binocular vision.

Interesting cases of unilateral amblyopia ex anopsia were encountered, in some of which there was also a comitant

strabismus of the amblyopic eye. It was noted that these individuals became more aware of their ocular defects after entry into Army service or assignment to overseas duty. They associated an inability to do ordinary tasks, not involving the use of their eyes, with either their defective vision or the strabismus. They gave a history of having consulted several Army oculists and of having had many refractions. A few of them contended they were aware of diplopia, although suppression of the visual image in one eye had existed prior to Army service. In all but one case I was unable to elicit diplopia. These soldiers were apparently attempting to use either the amblyopia or the strabismus as an escape from a disagreeable situation. Most of them were referred to a neuropsychiatrist.

There were no instances of definite or persistent ocular malingering. A few individuals were seen every month who half-heartedly feigned poor visual acuity in a normal-appearing eye. Most of them were Negroes assigned to engineering units. Once these soldiers were shown that their visual acuity was normal they returned to duty satisfied.

A few cases of presbyopia were encountered, but it was possible to handle them without resorting to bifocal lenses.

DISEASES OF THE EXTERNAL EYE

Approximately 500 cases (20 percent of the total) comprised this group.

Chronic, nonspecific conjunctivitis; blepharitis; hordeola; and chalazia were the predominant diseases treated in this group. I came to regard these conditions in this locality as phases of the same disease, the conjunctivitis and blepharitis representing the initial stage and the chalazion the end result. They were observed in both male and female personnel, blonds and brunets, individuals in outdoor as well as indoor occupations. Serv-

ice in this theater seemed a contributing factor, since many of them never before had experienced such ocular conditions. Dust was an ever-present nuisance. Cultures and smears of the ocular secretions from these cases revealed no consistent pathologic organisms. The cases of blepharitis caused the most difficulty. With hospitalization, the severest cases subsided in from four to five days. Once the patient returned to duty the blepharitis usually recurred, and the soldier plagued the dispensary medical officer with a seemingly incurable, chronic disease. However, it did not seem that sufficient attention was given at the unit dispensaries to treatment of the early stages of this disease. With a little more attention to local therapy and local hygiene, these cases could be kept in check, making hospitalization unnecessary. From the standpoint of the time spent on sick call and in hospitals, these diseases were an important problem among Army personnel.

Pterygia occurred in about the same frequency as would be seen in a civilian practice located in an agricultural community. However, pterygia among soldiers were larger and progressed more rapidly. The usual surgical methods for correction of the pterygia were not always successful. An average of one soldier per month came to the eye clinic with a recurrence of the pterygium; some had had several operations. The eyes with recurrences appeared to have had some type of transplantation operation, but the apex of the pterygium was reattached to the surface of the cornea. Several of these individuals had been operated on by competent Army oculists so that it was not a question of skill. I did not have an opportunity to observe after a lapse of several months the cases on which I performed a transplantation operation. Other oculists probably observed recurrences in the cases in which I operated. Some de-

gree of corneal opacity occurred following the transplantation or excision of large pterygia. In the Army service it seems wise to operate on the pterygium as early as possible in its growth period.

Burns of the eye were produced by a wide variety of external agents. Refrigerating fluids, ether, acetone, sulphuric acid, battery acid, chemical smokes, ultraviolet rays from the welder's torch, hydraulic-brake fluid, ignited kerosene, and explosions of gasoline were the causes found among the case records. The emergency care of ocular burns by the unit medical officer was excellent in all cases. With the exception of burns resulting from refrigerating fluids, the corneas recovered their transparency, and there was little impairment of visual acuity. In all cases the burns were bilateral. Burns produced by exposure to the welder's torch recovered most rapidly; burns from refrigerating fluids responded least to therapy. A 2-percent solution of sodium bicarbonate was the most frequently used irrigant. This weak, alkaline solution seemed more soothing to the patient than solutions of boric acid, water, or normal saline. A 2-percent solution of butyn, a 0.5-percent solution of pontocaine, and a commercial type of ointment combining 2-percent butyn and 1:3,000 metaphen were used with equal efficacy for relief of pain. Atropine was routinely instilled. In combat zones, topical analgesics were sometimes not available. Burns produced by explosions of gasoline following aircraft accidents were contaminated with dust, dirt, and pieces of cordite. Recovery from such burns was better than I anticipated.

An interesting case of the last-named type came under observation at a field hospital. Seven survivors of an airplane crash were brought to the hospital with burns of much of the body surfaces. Another Army ophthalmologist and I shared

the care of the ocular burns. In the confusion attendant upon the admission of these patients one individual's eyes were overlooked. This patient remained in a semicoma for six days. Eye therapy throughout this interval consisted of boric or normal saline drops routinely instilled by the nurses. On the seventh day the patient was sufficiently aroused to complain bitterly about pain in his eyes. It was then discovered that he had not been seen by an oculist prior to that time. Upon inspection of the eyes two thirds of the surface area of each cornea stained with a solution of fluorescein. The denuded areas did not appear to extend deeper than Bowman's membrane. The margins of the burned areas were not necrotic. The conjunctivas were of normal appearance. The entire external surfaces of the eyes appeared clean and free from secondary infection. The eyes were patched for 24 hours and the corneal surfaces were soon covered with epithelium. Ultimately visual acuity was normal. It seemed that the simple, mechanical washing of the conjunctivas carried out by the nurses forestalled secondary infection and contributed to the satisfactory outcome.

Acute keratoconjunctivitis was a problem in this area. Clinically the cases resembled those described in the United States as "shipyard conjunctivitis." In half of these cases, cultures of the discharge revealed *Staphylococcus albus*. In the remainder, repeated cultures and smears were negative. The local use of such drugs as sulfadiazine, zinc, argyrol, and mercuric oxide failed to influence the course of the disease. Oral intake of sulfadiazine likewise was of no benefit. Penicillin instilled at frequent intervals into the conjunctival sac seemed to be the most efficacious of all drugs tried. Oftentimes a herpes labialis appeared at some time during the course of the disease. Two cases were associated with a solitary, herpes-

like lesion on one eyelid. In both a typical dendritic keratitis developed. I felt that these cases were caused by a virus, although conjunctival scraping stained with the available dyes did not reveal inclusion bodies. The ultimate recovery was good. From a military standpoint, these soldiers were incapable of duty for from four to five weeks.

Several cases a week were referred from the dermatology department with inflamed conjunctivas and dermatitis of the eyelids. In all of them, there was either an eczematoïd or exfoliative dermatitis of various body surfaces. I found nothing that would cure the eye condition so long as the dermatitis persisted. The local use of penicillin either as an ointment or in solution was the most efficacious in reducing the congestion of the conjunctivas and eliminating the discharge. The discharge from the conjunctivas seemed particularly irritating to the skin of the eyelids. A thin layer of zinc-oxide paste applied to the eyelids after all crusts and flakes were brushed away proved to be the most beneficial therapy for the surrounding skin. Keratitis was prone to develop if eye irrigations were neglected. *Staphylococcus albus*, hemolytic and nonhemolytic streptococcus, and gram-negative bacilli were most often cultured from the conjunctivas.

The remaining external eye conditions encountered were of a miscellaneous nature; for example, corneal ulcers, iridocyclitis, scleritis, blepharospasm, corneal opacities, phlyctenular conjunctivitis, dermatitis medicamentosa of the conjunctivas and eyelids, papillomas, dacryocystitis, and melanomas of the conjunctiva. There was nothing among this group of an unusual nature. The corneal ulcers were the result of incomplete removal of superficial foreign bodies. Progressive, serpiginous ulcer did not occur if the foreign body was completely removed at

the initial visit. The cases of iridocyclitis were mild and fewer than I expected. An unusual type of corneal opacity that seemed peculiar to soldiers serving in the tropics was observed. Observations on this peculiar eye condition have been forwarded for publication.

OCULAR CONDITIONS PRODUCED BY TRAUMA

In contemplation of such a report as this, all ocular conditions produced by trauma were carefully recorded and classified. There were two reasons for this special attention. First, I assumed that ocular trauma would be very frequent among Army personnel. Secondly, I assumed that the factors responsible for the trauma would be far different from those observed in an industrial or civilian practice. Both of these assumptions I found to be incorrect.

Only 170 cases (8 percent of the total number of patients) of ocular trauma were encountered. Of these only 60 (2.5 percent of the total registration) were produced by combat with the enemy. The remaining cases were produced by the hazards common to everyday living.

The ocular injuries received in combat areas were always severe and usually unilateral. Either traumatic cataract, retained intraocular foreign body, panophthalmitis, prolapsed iris, or intraocular hemorrhage was the end result. Bullets, shrapnel, booby traps, and pieces of coral were the offending agents among combat troops. Injuries to the eye unaccompanied by wounds or lacerations of other body surfaces were incurred while the soldier was peeking over the rim of a foxhole. Oftentimes the missile was small and dropped out of the eye by the time the soldier reached an evacuation hospital. The retained foreign bodies were most often nonmagnetic. The Berman localizer helped us to determine the magnetic prop-

erties of the foreign body. The traumatic cataracts were not different from those seen in civilian practice. Iridodialysis was seldom observed. Dislocation of the lens was not seen. Prolapse of the iris was easily corrected in all instances, but these cases were seen shortly after injury. Panophthalmitis developed in about one third of the cases in this group. The incidence of this complication seemed in proportion to the time interval between injury and the first examination by an ophthalmologist. Once panophthalmitis had developed, parenteral, oral, or local use of sulfadiazine and penicillin seemed to have no effect.

In 55 percent of the cases, the factors responsible for the trauma were unavoidable and did not involve contact with the enemy. Detached retinas, contusions of the eye, orbital fractures, and the ophthalmoplegias were incurred in this manner. The cases of detached retinas were seen in Air Corps mechanics who had unwittingly bumped their heads on a protruding part of the airplane. The orbital fractures were usually associated with fractures of the mandible and maxillas. Manipulation of the body and frontal process of the malar bone was the most difficult feature of these orbital fractures. Reduction of the mandibular fracture and occlusion of the teeth were first necessary to secure a foundation on which the other facial bones could be manipulated. I was fortunate in that an oral surgeon was available to carry out these procedures. Ophthalmoplegias were induced by crushing injuries to the head. Function of the external rectus muscle was most frequently impaired; function of the superior oblique was the least apt to be impaired. When more than one ocular muscle was paralyzed, internal ophthalmoplegia was also present. In none of the cases of external ophthalmoplegia did normal muscle function become reestablished

during an observation period of six weeks.

Five percent of the cases of ocular trauma were attributed to carelessness. Individuals so injured were usually members of a detail engaged in cleaning fire arms, working on rifle ranges, or disposing of refuse. The gun that someone said was unloaded claimed many victims. The unsuspected bullet or powder charge that exploded when a pile of refuse was ignited accounted for three of the four cases of ruptured globes. Hammering on shell casings and melting bullets for their lead content were also frequent sources of ocular injury.

MEDICAL AND NEUROLOGICAL OPHTHALMOLOGY

Approximately 280 cases (11 percent of the total) composed this group. In this theater there was an opportunity to examine the fundi of individuals suffering from diseases not usually seen in civilian practice; such as, tsutsugamushi fever, malarial fever, and dengue. Although other ophthalmologists told me that retinal hemorrhages were apt to occur during an attack of tsutsugamushi fever, I was unable to detect any alteration in the retina, optic nerve, and choroid in the 45 cases that I had the opportunity to examine. These cases of "scrub typhus" were examined during all phases of the disease. The fundi were also normal in cases of cerebral as well as noncerebral types of malaria. However, in many of the cases of malaria and "scrub typhus" subconjunctival hemorrhages developed or hemorrhages in the fascial investments of the ocular-muscle tendons. There was nothing in the configuration or the location of these hemorrhages that was peculiar to either of these diseases. Neither was I able to determine in which cases hemorrhages in the external coats of the eyeball were likely to occur. Hemorrhages in the

subconjunctival tissues were frequent with "scrub typhus," infrequent with malarial fever. The hemorrhages occurred with sufficient frequency in the former disease to be of diagnostic significance. The triad of subconjunctival hemorrhages, fever, and lymphadenopathy often proved sufficient to make a diagnosis of "scrub typhus" in early cases, even though an eschar was not found. Aside from the intense retro-orbital headaches and dull pain upon ocular rotation, ocular complications during the course of dengue were not observed.

Although most of the routine fundus-copic examinations proved to be negative, one or two patients a week would exhibit some pathologic lesion. Several cases of acute vasospastic retinitis were seen initially on the eye service, and the patient was subsequently evacuated because of hypertension. Narrowing and sclerosis of the retinal arterioles compatible with a diagnosis of benign hypertension were occasionally observed. Retinitis of anemia was observed among cases of thrombocytopenic purpura, aplastic anemia, and myelogenous leukemia. Retinitis of diabetes was very infrequent, and no fundus-copic changes accompanying either acute glomerular nephritis or meningitis were recorded.

One of the most interesting conditions seen among the group occurred in a flyer who had bailed out over tropic waters. This aviator had floated in the water for three days and three nights before being rescued. According to the patient, his rescuers had commented on the marked swelling of his body tissues. On the medical record accompanying the patient was the observation that massive edema of the subcutaneous tissues of the thorax, neck, thighs, and legs existed. Ophthalmoscopic examination was made for the first time one week following rescue, when much of the body edema had subsided. I

do not recall seeing such extensive edema of the retina as existed in this patient. In the maculas alone there were large circumscribed masses of edema with elevation of the surface of the retina to three diopters. Several branches of the retinal arterioles supplying the macular areas were markedly narrowed, irregular in caliber, and surrounded by dense perivascular sheathing. These changes suggested an ischemic origin of the edema. It was felt that the prolonged immersion contributed to the changes observed in the retina.

About once a month an individual with papilledema was seen. These patients had suffered injury to the skull with either subsequent brain abscess, epidural bleeding, or subdural hematoma. Unequal pupils, nuclear ophthalmoplegias, conjugate deviations, and homonymous defects in the visual field were other ocular findings noted in these cases. In two individuals presenting complaints of headaches, but without previous head injury, bilateral papilledema was found. A provisional diagnosis of brain tumor on the basis of the neurologic and spinal-fluid findings was made.

Visual fields were frequently plotted of individuals complaining of postconcussion headaches. In only one case was a definite defect found in the visual fields. Perimetric studies were also useful to the neuropsychiatrists to corroborate the diagnosis of hysteria.

OCULAR SURGERY

Contrary to my expectations, there was comparatively little ocular surgery to perform. The cases requiring surgery constituted only 2.5 percent of the entire ophthalmologic practice. While working in a general hospital I observed patients on whom ocular surgery had been performed in more forward areas. These represented another 2 percent of the patients. In both field and station hospitals,

there was an opportunity to do more ocular surgery than in a general hospital.

In the field and station hospitals, the surgery was more of an emergency type. Ruptured globes, eyes requiring early enucleation or evisceration, the excision of a prolapsed iris, the management of a corneal laceration, and the repair of lid-margin defects were the problems usually encountered. In general and station hospitals in rear areas, traumatic cataracts, paralytic squints, iris synechiae, ptosis, detachment of the retina, manipulation of fractures about the bony margins of the orbit, and intraocular foreign bodies predominated. Pterygium surgery was common in hospitals of both forward and rear areas.

Much of the surgery performed in this area was done in open buildings. I worked in both open and closed buildings and, except for the factor of dust, it seemed to make little difference whether the operating rooms were closed or open. The incidence of postoperative infections was practically nil so long as the atmosphere was relatively free of dust. In a hospital located adjacent to a dusty, well-traveled highway, I observed that the postoperative course of my patients was not so smooth as in hospitals where the wards and operating room were farther removed from the roads. The eyes of patients who had been evacuated to this hospital from forward areas and who had had eviscerations, lid-margin repairs, or removal of an intraocular foreign body were often infected and their postoperative course was prolonged. These cases had little care enroute, and I believe that was the factor responsible for sloughing of sutures and tissue necrosis.

Except for pterygium surgery, the surgical techniques commonly employed in civilian life were applicable for ocular surgery in war zones. As mentioned in a previous paragraph, the pterygia among soldiers were prone to recur after the

usual transplantation operation. Plastic procedures on the conjunctiva with excision of the growth were necessary more often than in civilian practice. To forestall the recurrence of the pterygium and yet utilize the transplantation technique, I sutured the apex of the growth to the episcleral tissue as well as the overlying conjunctiva at the site of transplantation.

Because most soldiers were evacuated before six months had elapsed from time of injury, plastic procedures for cicatricial entropion and cicatricial ectropion were not carried out. The factor of time also limited the correction of traumatic ptosis. I felt that the ultimate cosmetic result of lid-margin defects was better if surgery was performed early rather than after scar tissue had formed. An occasion for glaucoma surgery did not arise.

The autoclaves and solutions for sterilizing eye instruments were adequate at all hospitals.

EQUIPMENT AND SUPPLIES

In a report such as this it seemed appropriate to discuss the instruments and supplies available to the overseas ophthalmologist. The equipment list for station and field hospitals included an assortment of forceps, hooks, probes, spatulas, keratomes, knives, knife needles, repositors, spoons, speculums, and scissors adequate for all types of ocular surgery. The ocular surgeon in an overseas general hospital was more limited in the scope of his surgery by a similar supply of instruments. Because of the long distances involved in evacuation to the United States and the relative limitation of space on hospital transports, patients often remained in general hospitals for an extended period of time. An opportunity to perform more definitive ocular surgery was thus possible except that some instruments common to the general hospitals in the United States were not provided. The surgical instruments available were

of standard design and of good quality.

The unavailability or shortage of replacements made it important to preserve those instruments which were received. In general, the ophthalmic equipment arrived in good condition. In field hospitals ocular surgery was often performed in conjunction with other emergency surgery. This necessitated the sterilization and mixing of the eye instruments with the larger tools of the general and orthopedic surgeons. Blunting or dulling of the instruments was the inevitable result. In the station and general hospitals this factor of handling was not such a problem. The prevalence of rust in the humid climate of the tropics and the realization that the same scissors and knives would have to be used over a period of several years put a premium on the instruments available to us.

The need for a magnet frequently arose not only in ocular surgery but for removal of particles in other tissues of the body. The magnet I received had been donated by a civilian practitioner. This particular instrument was unsatisfactory for the removal of tiny particles within the eye. Nonmagnetic instruments for use with the magnet were not included with the eye equipment.

An electrocautery with several types of points was received. The dermatologist and general surgeon found this instrument very useful for removal of cutaneous warts and tumors. So far as the eye was concerned some type of fulguration apparatus would have been more useful.

The equipment for refractions was complete except for cross cylinders. Where a large number of refractions are done the cross cylinder adds a great deal to the speed with which the patients can be handled, and for that reason it would be a valuable supplement to the diagnostic case. An additional trial frame would be appreciated, for there are so

many screws and joints to get into disrepair. There was some trouble with mold growth on the trial lenses along the coastal areas of New Guinea. If the trial case was placed in a box equipped with an electric lamp this nuisance was eliminated. The electric retinoscope was satisfactory. Heterophoria was determined with the trial frame, red glass, and Maddox rod. A phorometer was not provided.

Spectacles were obtained from strategically located optical centers. The average elapsed time between requisition and delivery was two weeks. Breakage in transit was negligible. A large variety of lens prescriptions was available for dispensing.

One of the most valuable items was the case for the fitting and repair of spectacles. Lost temple screws, bent frames, and loose nose pads brought many soldiers daily to the clinic. The tools, screws, and extra temple pieces made it possible to salvage the spectacles on the spot.

The ophthalmoscope heads projected a beam of light that was wide in diameter and was not of a make commonly used by the civilian practitioner. Anyone coming overseas should bring his own ophthalmoscope.

I came to regard the slitlamp and perimeter as valuable adjuncts to the overseas practice of ophthalmology. There were many occasions to use the slitlamp, had it been available. A perimeter was not included in the original equipment, but one was obtained from a base supply depot. Other ophthalmologists were not so fortunate.

For several months the hospitals were furnished a small supply of glass eyes. More recently they were collected and redistributed to certain key hospitals in the theater. The fitting and wearing of a prosthesis among patients awaiting evacuation was a big morale booster. The soldier who suffered an enucleation or evisceration was less self-conscious when

he was given a prosthesis before departure.

The hospitals in this area were first established in what was considered a combat zone. The field hospitals and most of the station hospitals were set up beneath canvas. Prefabricated buildings were provided for the general hospitals. Once the buildings and tents were erected, improvisation was necessary to complete the furnishings of the eye clinics.

A dark room was one of the chief needs. For field hospitals and some station hospitals a portable room seemed the most practicable. Pieces of press wood were obtained through local channels and nailed to wooden frames. A room of approximately 6 by 6 by 8 feet seemed adequate. For the general hospital, a dark room 20 ft. in length with sufficient space for a perimeter, slitlamp, and transilluminator was constructed. In the climate of New Guinea, ventilation in these rooms was important. Shielded inlet and outlet air vents were necessary. Still these rooms were too hot for prolonged occupancy. An electric fan easily solved the problem of ventilation, but fans were not a part of the initial equipment and had to be obtained by special requisition.

All of the diagnostic instruments were 110 volts, but the standard current from the generator was actually 240 volts. There were sufficient transformers available to handle the difference in voltage.

Rheostats were provided, and the electric bulbs for most of the diagnostic instruments were used over a long period of time before they burned out. However, the bulbs provided for the transilluminator were not of sufficient voltage adequately to carry the illumination necessary with this instrument. The transilluminator soon became useless for want of bulb replacements.

A wood or cement floor seemed desirable for eye clinics. With hard dirt or gravel floors it was not possible to keep

the eyes and instruments as free of dust as one would desire.

In general, the supply of drugs for use in the eyes was adequate except in the forward areas. In such areas there was a scarcity of topical analgesics such as butyn and pontacaine. Homatropine was another drug not easily obtained. Cocaine was available, but one hesitated to use the drug for expediting the removal of foreign bodies in the cornea. Atropine, the old standby, was always available. An item that found universal use among hospitals, unit dispensaries, and aid stations was a common commercial ointment combining butyn and metaphen. I saw few undesirable reactions in eyes to which this compound was applied. It provided a good deal of comfort to the patient during his transit to an ophthalmologist. It was a useful item for emergency eye therapy. There was little occasion for the use of physostigmine.

Intravenous typhoid vaccine was a very useful agent in the treatment of stubborn cases of conjunctivitis, keratitis, iritis, and intraocular conditions of either endogenous or exogenous origin. Eyes responded to Army typhoid vaccine where all other therapeutic measures failed. However, there was one difficulty. Every bottle of typhoid vaccine I received was long antedated, frequently over six months. I soon discovered that the potency of the vaccine was proportionate to its age. An initial dose of from one to five million organisms was usually adequate. In higher initial concentrations the fever was prone to go above 102°F., a 12- to 18-hour period of fever was apt to occur, secondary and tertiary reactions would appear, and the patient experienced severe chills. Even with such severe reactions I did not see any kidney or liver complications. I feel that Army typhoid vaccine is a safe agent for intravenous use so long as its increased potency is kept in mind.

DISCUSSION AND SUMMARY

The patients from which the data for this report were gathered were a good composite of combat and noncombat personnel. The total number of soldiers examined would probably approximate the average observed in other hospitals in this area over a like period of time. It was not the purpose of this report to formulate definite conclusions but only to comment on the trends of an ophthalmologic practice among such a group of soldiers.

I was not prepared before coming to this area to find that such a large proportion of an overseas practice would be devoted to refractions. Rather I had assumed that my time would be more occupied with the treating of external eye diseases and repairing the effects of trauma. Many of the individuals examined in the refraction room probably would not have consulted an oculist in civilian practice because their eye complaints were so frequently linked up with other bodily complaints peculiar to service in the Army.

Unilateral amblyopia ex anopsia among overseas personnel was more of a problem than among civilians similarly affected. Many of the soldiers had been told they would not be sent overseas. Others cited various reasons why they could not get along overseas so long as they possessed the amblyopia. I felt that unilateral amblyopia ex anopsia was compatible with overseas service so long as the soldier was assigned to tasks in a noncombat area not requiring extensive use of the eyes. Hysterical amblyopia seemed more common among noncombat personnel than in combat troops.

Among the external eye diseases chronic, nonspecific conjunctivitis and blepharitis accounted for the most patients. These diseases were more of a nuisance than a therapeutic problem, and blepharitis, in particular, was responsible

for many soldier hours lost on sick call. Acute keratoconjunctivitis was a problem from the standpoint of prolonged hospitalization and the failure of any local therapy materially to shorten the course of the disease. The etiology of this condition was not satisfactorily determined. Atypical lichen planus and other dermatoses were frequent among soldiers in this area, and secondary involvement of the conjunctiva was not uncommon. Local penicillin therapy was tried for some of the external eye conditions. As a therapeutic agent for local use in the eyes it seemed more efficacious than many of the standard drugs employed in civilian practice, but it was not used in a sufficient number of cases to allow formulation of definite conclusions. Burns of the eyes among soldiers were probably as frequent as burns among civilian personnel working in industrial areas. Prompt treatment was usually possible, and the outcome was uniformly good, except in those eyes that had been burned by refrigerating solutions.

From the limited scope of this survey it seemed that traumatic conditions of the eyes did not comprise a great deal of the overseas ophthalmologic service. Eye injuries as the result of combat, in particular, seemed relatively infrequent. Perhaps the helmet worn by our troops in this war was a factor that influenced the low incidence of eye injuries. The eye injuries among noncombat personnel were produced in a manner not unlike those observed in civilian life.

Medical and neurologic ophthalmology composed but a fraction of the professional work performed by overseas hospital groups. However, when the infrequent need for such examinations did occur, the oculist usually assisted in the

differential diagnosis. The neurologist, neurosurgeon, neuropsychiatrist, and internist regarded the ophthalmologist as a handy man to have around when puzzling cases occurred. In this theater approximately 11 percent of the eye patients were examined from the standpoint of these specialties. The opportunity to examine the eyes of patients suffering from diseases endemic to this theater was of particular interest to me. Objective changes in the eyes did not seem to occur with dengue fever; in malaria they were not frequent. Hemorrhages in the subconjunctival tissues of the cases of "scrub typhus" occurred frequently enough to be of diagnostic significance. Although the pathology of "scrub typhus" is vascular in nature, alterations of the choroidal and retinal vessels did not occur in the cases I examined.

Ocular surgery comprised but a small portion of the eye practice. In view of the hazards of warfare I anticipated that surgical cases would be more plentiful. The types of surgery performed in overseas units seemed to vary according to the distance between the hospital and the combat zone.

In general, the equipment furnished the overseas ophthalmologist was adequate and of good quality. Some improvising was necessary in the construction and furnishing of the eye clinics. The occasional shortage of ophthalmic drugs in forward areas seemed not a matter of supply so much as one of distribution.

From a professional standpoint I found my overseas experience an interesting one. There was a good variety of ocular conditions to observe and treat, and the patients were appreciative of their care.

THE REMOVAL OF ADJACENT NEVI OF THE EYELIDS*

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The various and ingenious procedures for the repair of deformities of the lids after surgical removal of tumors have always been fascinating. Many of these depend upon the opposing lid for tissues to supply the loss. In the following case report the tumors were adjacent on opposing surfaces of the right lids, and the problem was solved by utilizing a combination of procedures.

A man, aged 21 years, stated that while an infant it was noted that he had a small brown spot on the lower right lid. This spot was located just below the lashes and at about the junction of the middle with

that of the lower (12 mm. by 6 mm., fig. 1). Only at the lid margins did the nevi extend through the entire thickness of the lid, and neither tarsus was involved (fig. 2). A general physical examination revealed no other such nevi, but on the

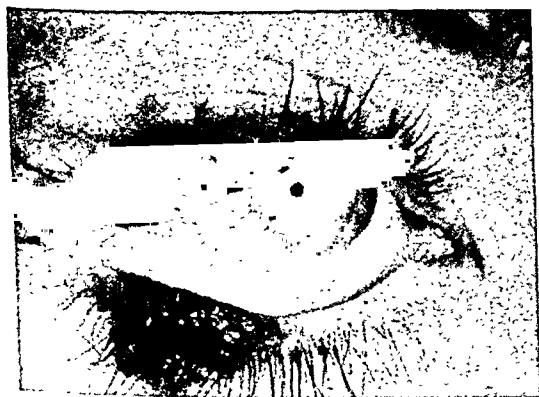


Fig. 1 (Callahan). Adjacent nevi of the lids. The upper measures 15 mm. by 6 mm.; the lower, 12 mm. by 6 mm.

the lateral third of the lid. This area of pigmentation was not elevated and did not begin to increase in size until about seven years ago. The rate of growth was very slow, and two years ago it extended to the upper lid. When first examined in February, 1945, the nevus of the upper lid was larger (15 mm. by 6 mm.) than

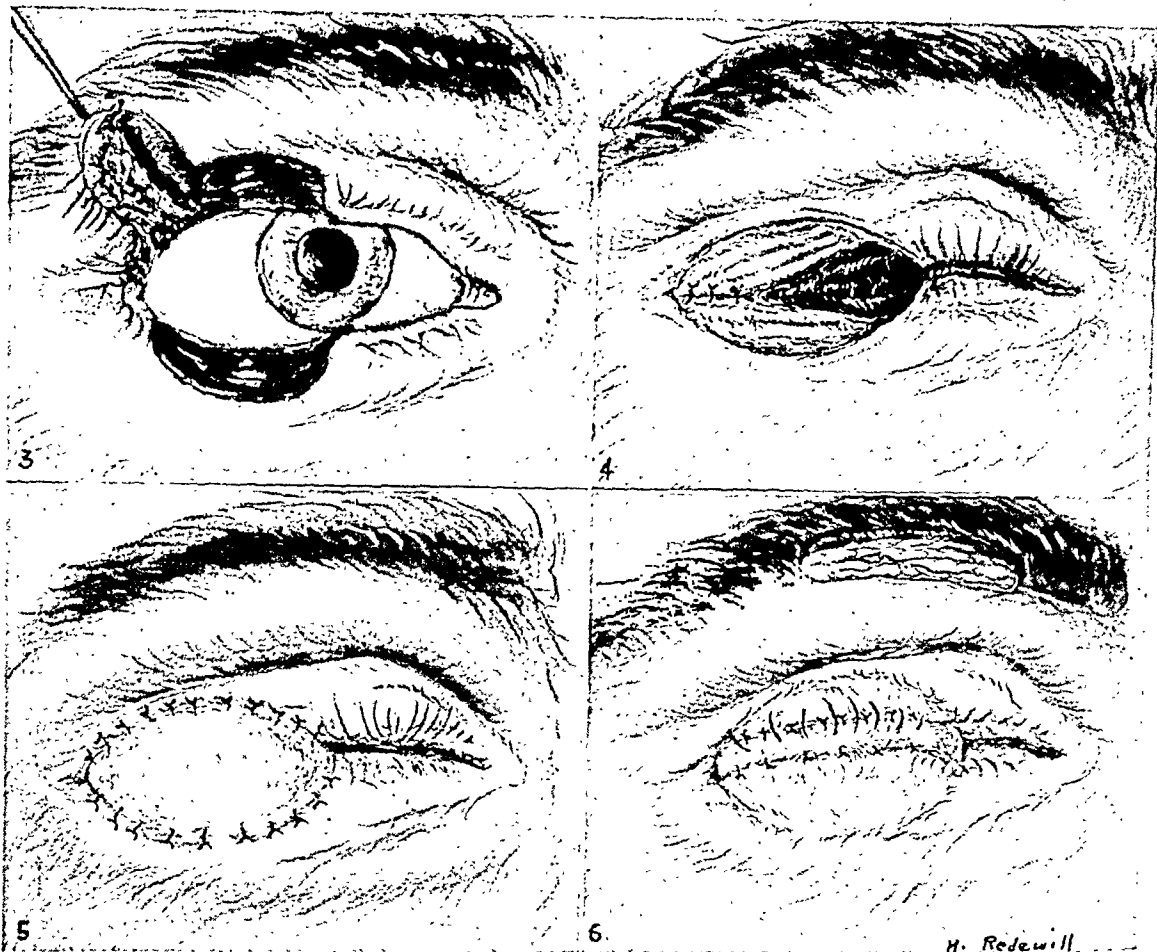


Fig. 2 (Callahan). Adjacent nevi of the lids, with upper lid everted, showing involvement of the margins.

shoulders and upper back there were found many small spots of brown pigment. No melanin was found in the urine.

The first-stage operation was performed on March 12, 1945. Avertin was used as a basal anesthetic, supplemented by novocaine block of the supraorbital and infraorbital nerves. Diathermy cutting current was used to remove the nevi with 3 to 4 mm. of normal tissue surrounding them. The lower nevus was removed first (fig. 3). Dural hooks were used to hold the tumors, and the use of grasping forceps was avoided. The coagulated skin edges and the coagulated mucous-membrane edges were then removed with a scalpel. In the region of the nevi both lids were divided into a posterior lamina of tarsus with mucous

* Presented as a motion-picture to the Louisiana-Mississippi Ophthalmological and Otolaryngological Society, April 27, 1946, at New Orleans.



H. Redwill

Figs. 3, 4, 5, 6 (Callahan). Steps in the operation for removal of nevi. Fig. 3, The tumors are held with small hooks, the use of grasping forceps being avoided. Diathermy cutting current is employed to divide the nevi from the lids. Fig. 4, The posterior laminae of conjunctivas and tarsi are joined with chromic catgut 4-0 interrupted sutures. The muscle and subcutaneous tissues are partly joined with the same suture material. Fig. 5, Free skin graft, removed from left upper lid, is sutured into place with silk 4-0 interrupted sutures. Fig. 6, Hair-bearing skin graft placed in center of free skin graft. This operation was performed three months following that shown in figure 5.

membrane, and an anterior lamina of skin, subcutaneous tissue, and muscle. The posterior laminae were joined with chromic catgut sutures and the subcutaneous tissues and muscles were then joined similarly (fig. 4). The skin defect was supplied by a free skin graft from the left upper eyelid (fig. 5). To prevent undue tension on the medial extremity of the graft, a Wheeler lid adhesion was placed half the distance between the graft and the nasal end of the lids. To prevent the bed for the graft from shrinking, one tension suture was placed from the upper

lid into the supraorbital tissue and another from the lower lid to the cheek.

Microscopic examination of the tumors revealed clusters of nevus cells and considerable melanin pigment beneath an atrophic epithelium. There was no evidence of malignancy, and the diagnosis was made of benign moles.

The graft grew excellently, and almost the normal degree of elasticity of skin and subcutaneous tissues returned.

On May 28, 1945, the second-stage operation was performed. An incision was made through the skin into the subcu-

taneous tissues across the center of the previously transferred skin graft. The skin edges were slightly undermined. An area of hair-bearing skin, the width including four rows of cilia and the length approximately that of the previous skin graft, was removed from the right eyebrow. This was not rotated, but kept in the same relative position and sutured into the incision created for it (fig. 6). No cilia were planned for the margin of the lower lid, since they are not prominent.

This area of hair-bearing skin grew excellently, but, as is often the case, the cilia present in the graft fell out, a few at a time, with loss of all in about 10 days. In three weeks, however, the hair follicles of the center rows had begun to grow new cilia, and by the latter part of July there was an excellent line of them. On August 3, 1945, the lids were divided just below the cilia.

On August 20, 1945, the patient was discharged with relatively normal lids and a slightly irregular but not conspicuously abnormal lash-line of the upper right lid. The new cilia turn upward, forward, and have an inclination laterally (fig. 7).

Comment. The satisfactory result obtained in this case (compare figures 1 and



Fig. 7 (Callahan). Final appearance after division of lids, performed two months after transplant of hair-bearing skin.

7) encourages the early removal of nevi which show a tendency to growth after a long period of quiescence.

In this case the pathologic report revealed no malignancy; but, in a spreading nevus, a protracted delay would have meant further unsightly involvement of both lids with the necessity of more extensive surgical procedures when finally removed. There is always the possibility, of course, that malignant changes may set in.

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THE RELATIONSHIP OF RUBELLA IN THE MOTHER TO CONGENITAL CATARACTS IN THE CHILD*

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In 1942, Dr. N. McAlester Gregg,¹ an Australian physician, called attention to the occurrence of congenital cataracts in infants whose mothers had had German measles in the early months of pregnancy. In 1943, a nationwide investigation was conducted by the National Health and Medical Research Council of Australia.² Dr. Algernon B. Reese³ reviewed the reports of the Australian physicians in 1944 and added three cases of his own.

In Gregg's report, which consisted of 78 cases, 20 of which he had examined personally and the records of the remainder of which he had studied, most of the babies were undernourished and presented feeding problems; all had cataracts from birth, 62 of them bilateral; most of them had heart lesions; all had poorly developed musculature, and the majority had subnormal mentality.

We wish to report six cases seen from the Houston area between July, 1943, and December, 1944. Five of these were bilateral, one unilateral. An additional case is reported which has all the earmarks of the syndrome, but which lacks a history of rubella in the mother.

CASE REPORTS

Case 1. Barbara M. was born at full term and of normal weight. The mother had contracted rubella during the first month of pregnancy. The cataracts had been noted at birth. We saw her when she was seven months old.

The eyeballs were much smaller than normal, the pupils were completely

opaque; there was a coarse lateral nystagmus and alternating convergent strabismus. She had a congenital heart lesion and defective hearing. The pupils were equal and reacted promptly to light. They dilated regularly and well with homatropine and paredrine, showing a clear ring of tissue around the opaque center. The right lens was needled by Ziegler's method when the child was 11 months of age and the left one a few weeks later. There remains a membrane across each pupil and there is a high degree of alternating convergent strabismus and severe nystagmus. The mother writes that the baby's vision is improving, that she picks up small objects and notes colors.

Case 2. Stephanie S., aged three weeks, was examined on December 6, 1943. The child was born at full term and weighed seven pounds. The mother had had German measles during the second month of pregnancy. Both eyeballs were microphthalmic; the lenses in the pupillary area were completely opaque. The pupils dilated equally and well, showing an opaque center with some clear lens substance in the periphery. The opacity seemed to come farther forward in the left eye. This was a "blue baby," probably from absence of the interventricular septum. It was thought best to give the baby time to gather strength before operating. On September 21st a needling was performed on the right eye. This left a thin membrane, which was incised on November 6, 1944, at the same time that the lens of the left eye was needled. The tiny opaque nucleus came into the anterior chamber and took several weeks to become ab-

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sorbed. The child now has clear pupils, with alternating convergent strabismus.

Case 3. George F. was seen on December 20, 1943, when he was three months old. He was born at seven months, was a twin, the other baby having been still-born. He weighed $3\frac{1}{2}$ pounds. The mother had had German measles in the first month of pregnancy. The child was poorly developed and had a congenital heart lesion. At 19 months he weighed $18\frac{1}{2}$ pounds, did not crawl nor stand alone, and threw his head backward in a manner characteristic of these infants. The pupil of the left eye was opaque at birth, that of the right not completely so, but at the examination both seemed the same. There was a fine lateral nystagmus. The eyeballs were considerably smaller than normal. The pupils dilated fairly well. There were no posterior synechiae. A small ring of clear cortex surrounded the opaque centers. On July 24, 1944, the lens of the left eye was needled. The lens material was not absorbed well, and a rather thick membrane remained which became vascularized from large vessels in the iris. The lens of the right eye was needled on September 7th and the nucleus was broken up with the knife. The membrane and iris of the left eye were incised at the same operation. The baby now has a clear black pupil in the right eye, and an elongated slit in the left.

Case 4. Carolyn M. was brought for consultation March 21, 1944, when she was three months old. She was a full-term baby and weighed 4 lbs., 6 oz. at birth. She was the fourth child, the other children all having normal eyes. The mother had had rubella early in the third month of pregnancy. The baby had a congenital heart lesion and poorly developed musculature. Both eyes were very small, and the

pupils were completely obstructed by opaque lenses. There was a coarse lateral nystagmus. The pupils dilated poorly but there was no synechiae. A small rim of clear lens material surrounded the opacities. On October 21st the lens of the right eye was needled and the nucleus broken up with the knife. On December 13th the same operation was performed on the left eye. The baby now has clear black pupils, but in the left eye the iris is adherent to the puncture wound. At 16 months the child can sit alone but cannot stand nor walk. She seems apathetic and doubtless has subnormal mentality.

Case 5. Judith M. was brought for consultation on May 15, 1944, at five months of age. She was an 8-months baby and weighed 5 pounds at birth. She had gained 6 pounds since birth and looked well nourished. She was the second child, the first being normal. The mother had German measles in the first month of pregnancy. The child had a congenital heart lesion and became somewhat blue on exertion. There was a slight lateral nystagmus. The eyes were somewhat smaller than normal. The pupillary area of the right eye was completely covered by the lens opacity; that of the left was less dense. There was a rim of clear lens material in each periphery. The pupils did not dilate well with any mydriatic. Needling was performed on the right eye on September 8th. The lens substance was absorbed slowly, leaving a white spot in the center of a thin membrane. On November 21st the membrane was incised and at the same operation the lens of the left eye was needled and the nucleus macerated. The lens material in the left eye was absorbed poorly, so it was attacked again on January 5, 1945. By January 25th there was a clear central opening surrounded by unabsorbed lens substance. At 17 months the child does not sit nor

stand alone. It has intermittent convergent strabismus and a fine lateral nystagmus.

Case 6. Sammie L., aged nine months, was examined on September 11, 1944. There was a cataract in the left eye completely covering the pupillary area. With the pupil dilated it was found that only the central area was involved, with a clear ring about it. The eye was definitely smaller than the other. There was no nystagmus. The lens of the right eye was clear. The mother had had German measles early in the second month of pregnancy. The child was born at term and weighed $5\frac{1}{4}$ pounds. He was a difficult feeding problem and had a behavior pattern similar to that of the babies with bilateral cataracts—such as dropping his head backward and pressing on the eye with the hands. We did not operate upon this child.

Case 7. John W. P., Jr., was brought to us for consultation on December 12, 1944, when he was one year old. He was undernourished, poorly developed, and had a congenital heart lesion. The eyes were about normal in size; both pupillary areas were obstructed by opaque lenses. The pupils dilated poorly but some clear lens materials surrounded the central areas. Both ears were discharging. The mother denied having had any illness during pregnancy that could be called German measles. The baby was referred to the University of Texas Clinic for operation.

SUMMARY

In reporting these cases we are presenting nothing new, but there has been very little published about it in the American literature and it seems that the appearance of six cases of congenital cataracts in infants whose mothers had rubella during pregnancy, in one office, within a year, makes it a serious enough

problem to merit more discussion. Throughout the Gulf Coast area of Texas an epidemic of German measles occurred in 1942 and 1943. The cause of this disease is unknown but it is quite infectious. Affected persons were not very sick with it and in some cases it was probably so mild as to make little impression. That is possibly what happened in case 7. The epidemic was characterized by pharyngitis, cervical adenopathy, mild fever, and a papular rash which began on the face and spread downward.

There are several peculiar features about this syndrome that in the light of our present knowledge defy explanation. The deformities following German measles in the mother are too much a part of the picture to pass it off as a coincidence. It is true that we have never thought to question the mothers of children with congenital cataracts concerning this kind of infection until it was called to our attention. It seems likely that through the placenta some toxin reaches the embryo that is specific in arresting the development of certain organs, particularly the eyes, the heart, the auditory apparatus, and perhaps the central nervous system. The Australian investigators found that if the mother contracted German measles within the first two months of pregnancy the chances of the child being affected were 100 percent; whereas if the infection appeared in the third month they were 50 percent. Presumably from there on the percentage drops rapidly. This of course brings up the question of the justification for therapeutic abortion when the postulates for 100-percent affection of the child have been fulfilled. Personally we believe that it is better that these miserable little creatures be not brought to birth. Convalescent serum has been used on mothers, but so far as we know no reliable statistics as to its efficacy are available.

These cataracts differ from other congenital cataracts that we have seen. They are usually in microphthalmic eyes, which in itself is bad. The embryonic nucleus is usually alone involved, and may have become so tough and hard that it is difficult to fractionate. In this event absorption is slow. Because of the poorly developed muscles of the iris it is difficult to dilate the pupils with any mydriatic and to keep them dilated after operation. Fortunately, these do not have the characteristics of congenital cataracts caused by intrauterine inflammation as denoted by firm posterior synechiae. We have never seen an eye of this kind successfully operated upon, for each operation is invariably followed by inflammation and fibrosis.

All of our patients were operated upon under ether anesthesia, and no difficulty was encountered. This is contrary to Lawrence Post's experience. He advocates local anesthesia. We encountered no trouble with secondary glaucoma after operation. This may be due to the fact that the lenses were so small that the material turned loose by the knife was not sufficient to swell and close the angle, or for the debris to clog it. As the eye also is small, often commensurate with the size of the lens, another factor may explain it. This is the type of discission in which the posterior capsule as well as the anterior is cut, as advocated by Ziegler years ago. We have had no secondary glaucoma in congenital cataracts since adopting this method.

It is probably wiser to operate upon these infants very soon after birth instead of waiting the 10 or 12 months usually advocated for congenital cataracts. This might prevent the searching movements these eyes develop and when this starts it never disappears. We did not operate as early as this on our patients because of their poor physical condition, but we have decided that the risk should be taken in the future. Glasses should be put on these babies as soon as clear pupils are obtained.

CONCLUSIONS

Seven cases of congenital cataracts are recorded, all of them accompanied by other defects, usually congenital heart lesions, poorly developed musculature, and retarded mentality. Six of these were bilateral, one unilateral. Six of the seven mothers had had German measles in the early months of pregnancy. One mother whose baby had the syndrome gave no such history.

The cataracts are typical in that the embryonic nucleus, which develops soon after the fibers are laid down, is affected.

Five of the patients had both eyes operated upon under ether anesthesia. The through-and-through discission advocated by Ziegler was done. Fair results were obtained in all cases. Secondary glaucoma did not occur.

It is doubtless wiser to operate upon these infants within the first two or three months of life, before nystagmus begins.

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HYSTERICAL AMBLYOPIA

ITS DIFFERENTIATION FROM MALINGERING

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In the Army, Separation Centers have been set up for the final complete physical tests for soldiers about to be discharged or "separated" from the Service. These soldiers are received from various Army hospitals or stations throughout the country and are, for the most part, selected because of physical or mental disabilities of sufficient degree so that no suitable assignment is available for them in Service. The men are sent to the Separation Center nearest their homes; the last station from which they return to civilian life. At the time of the final physical examination definite diagnoses must be made together with a ruling as to whether the condition is or is not in line of duty or aggravated by military service. Records from previous stations or hospitals aid in the final diagnosis and evaluation.

In the Ophthalmology Department of the Separation Center at Fort Snelling, Minnesota, a number of interesting and unusual cases of poor vision were encountered, all of similar pattern. The first of these was not immediately recognized and resulted in an incorrect diagnosis of ocular malingering. From the records that accompanied these individuals it could be deduced that previous examiners also had been uncertain of the condition present, and were in doubt about the diagnoses.

METHOD OF APPROACH

The soldier usually had an uncorrected vision of 20/200 or 20/100 in each eye which lenses did not improve to any appreciable extent. A pinhole in the trial frame placed first before one eye and then before the other gave the same re-

sults; namely, vision about 20/100. Flashlight observation of the lids, conjunctiva, cornea, and pupillary reaction was negative, and ophthalmoscopic examination of lens, vitreous, and fundus also showed no abnormalities. Of those with previous clinical records the examination also had proved to be negative except for poor vision. The records of some of the individuals showed consultation with the psychiatry department for evaluation, and malingering, hysteria, and neurasthenia were considered.

The majority of these soldiers were being discharged with poor vision, although previously upon entering the service they had passed the visual requirements. In all but three cases the vision originally had been adequate for general service, and although the ocular standards for general service have been changed from time to time since January, 1942, corrected vision of at least 20/40 in each eye had been the minimum requirement during most of this period.

After determining the distance vision with either lenses or pinhole spectacles or both, the visual acuity for close work was next determined by use of the Jaeger chart. In this test the results ranged from ability to read Jaeger 1 with ease, to difficulty with reading type one inch in height. The possibility of malingering was again suggested by these results, and this point will be enlarged upon later.

A visual field was then plotted on a tangent screen. In all these cases a markedly restricted field was found, varying between 1 and 25 degrees, with little or no increase in the size of the field as the patient was seated two or three times farther back than the original distance.

This, of course, is the so called "tubular field" characteristic of hysteria. These cases were also seen by the psychiatrists* at the Separation Center who helped in the clinical diagnoses.

After the desired data such as history, distance and close vision, ophthalmoscopic examination, and visual fields had been noted, the subject was taken aside, and in privacy the following line of suggestion was applied. A sympathetic and paternal attitude was assumed. It was explained that his present vision was poor, to which the soldier would usually agree in a sad tone of voice. However, because of this finding and since no immediate cause could be found for this decrease in vision by the present limited examination, it might be necessary to hospitalize him if a recheck did not show any change. The next step was that he should "rest his eyes" for 10 or 15 minutes. This "resting" was done in the dark room. After this, and still in a helpful and encouraging manner, all the tests were repeated, the results of which are reported later.

CASE REPORTS

Incidence. A total of 15 cases of hysterical amblyopia was seen during the examination of the first 1,700 cases at the Separation Center. Only 86 percent (1,462 soldiers) were discharged because of physical or mental defects, the remainder being separated for other reasons such as dependency, essential to the public health, and the like. The frequency should be calculated from the group with these defects, with a resulting incidence of just over 1 percent. However, these are not a random group of servicemen but rather

are selected cases recommended for discharge because of specific reasons. Thus one cannot learn from this report what the frequency is of amblyopia due to hysteria among servicemen in general except to say that it is not rare.

Age. Two thirds of the soldiers were in their twenties, with lower and upper limits of 20 and 39 years of age. The average service man was 27 years old, and the mean age 25.5 years. Since the general group of men in service are between 18 and 45 years old with a predominance of those less than 30, the average and mean ages found in this series correspond with the average age of service men. It cannot be said that hysterical amblyopia is predominantly seen in younger men.

Branch of service. There was no one branch of service to which a predominance of the cases belonged. Five were assigned to the Infantry, two each to the Signal Corps and Medical Department, one each to Ordnance, Combat Engineers, Cavalry, Coast Artillery, and Detachment of Enlisted Men's Lists; one was unassigned. That five cases were from the Infantry was to be expected, since this branch of the Army is by far the largest.

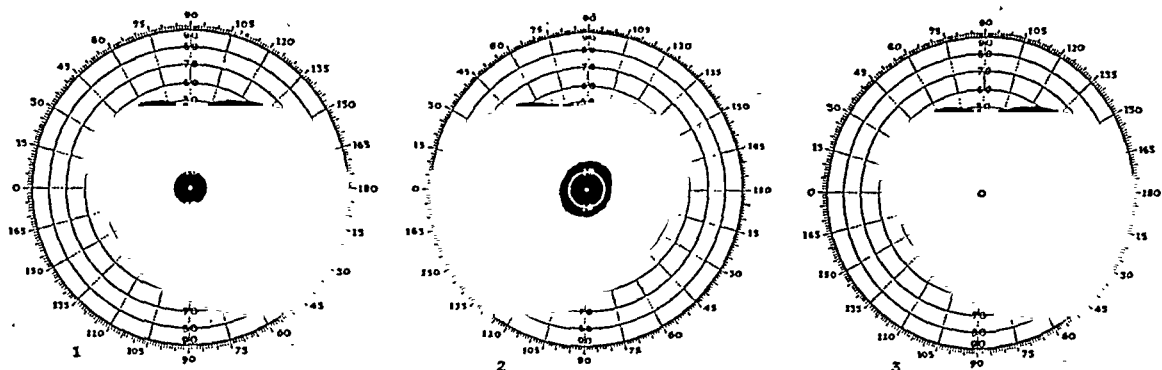
Length of service. In general, the men had been in service between one and three years, with extremes of 10 weeks and four years. Some had served well, and of the four who had been overseas two had been in combat under intense fire. However, during the last 6 to 12 months of their service the records had shown repeated treatments by the medical branch either in clinics or hospitals, with gradually diminishing value to the Service.

Vision. The optimum corrected vision on the initial examination was 20/200 or 20/100 in two thirds of the cases (table 1). This vision was obtained by glasses or pinhole spectacles, whichever gave the better results. It was both interesting and

* Marvin Sukov, Comdr. (MC), U.S.N. and John Miller, Capt. (MC), A.U.S. of the Psychiatry Department were most helpful in evaluating these cases and providing suggestions in the work-up.

characteristic that these men would read about 20/100 to 20/200, usually O.U., and not 20/400 or 20/800 or 20/50. Typically the soldier wearing his correction and using binocular vision would say, "I can only see the big letter" (20/200), or possibly read the next line (20/100), with great effort and long pauses between letters. Urging on the part of of examiner to have another line read would be

quent blinking, "resting of the eyes" by closing them for a few minutes, rubbing of the lids, and a pained expression were characteristic of the individuals. It would often take 10 or 15 minutes for the soldier to read from the 20/200 line to the lowest possible, with occasional rests during the test. Therefore, in the later cases reading was begun on the 20/40 line with progression to the smaller type.



Figs. 1, 2, 3 (Yasuna). Visual fields in cases of hysterical amblyopia.

Fig. 1, case 3. Soldier 33 years old, 38 months in service; overseas 27 months. Claims "weak eyes" since 1930, becoming worse in service. Vision: O.D. 20/100; O.S. 20/200, with 10-degree tubular fields regardless of size of test object (4 mm. at 1 M. and 3 M.; same size field with 4" object). Jaeger 1 read with ease. After suggestion, vision was 20/30 in each eye but the fields remained unchanged.

Fig. 2, Case 9. Soldier aged 31 years, 49 months in service; 32 months overseas. Claims "weak eyes" after shell explosion on Anzio Beachhead in November, 1943. Vision: O.D. 20/100; O.S. 20/70, with 15-degree tubular fields (4 mm. white test object with no change at 1 and 3 M.). After suggestion, vision was: O.D. 20/40; O.S. 20/30—; fields unchanged.

Fig. 3, Case 10. Soldier aged 37 years, 10 months in service; not overseas. Claims a poor right eye since childhood. Vision: O.D. 20/70; O.S. 20/20. Right field 2 degrees, left field 4 degrees (4 mm. test object at 1 and 3 M.; same size field with large sheet of paper). After suggestion, vision was O.D. 20/30; O.S. 20/20, while fields increased to 30 degrees in each eye and were not tubular.

of no avail. Most wore glasses, with refractive errors of all types represented. In only one was the ametropia of high degree, this being in the case of a hyperopia of seven diopters.

After suggestion, the corrected vision was improved to 20/30 or 20/40, and in some instances to 20/20. Here again the reading was slow and deliberate with long pauses between letters. This delay and great effort in reading frequently occurred whether the soldier was reading the 20/100 line or the 20/30 line. Fre-

Visual fields. Visual fields were plotted on the tangent screen rather than on the perimeter.* In all except one (case 6) the fields were tubular in character; in the one exception, although the fields enlarged as the distance from the screen was increased, the enlargement was by no means proportional. In this case the fields were also found to be considerably re-

* One of the black painted walls of the dark room was used as the tangent screen. This served well since it was possible to obtain privacy and quiet, both of which were desirable in testing these men.

duced. The usual plotted field, when a 4-mm. white test object at one meter was used, was found to be between 8 and 15 degrees in 13 (86 percent) cases. Use of the same test object at three meters gave identical fields (figs. 1 and 2). In the remaining two cases, very small fields between 2 and 4 degrees were obtained with no enlargement at three meters (fig. 3).

In addition to the tubular characteristic, certain peculiarities concerning the fields in these individuals are worthy of mention. First, the plotted fields were found to be uniformly round rather than with the normal increase temporally and temporo-inferiorly (fig. 1). If a 10- or 15-degree field was obtained, the isopter distance from the fixation point was as regular as though drawn by compass, and this finding persisted regardless of the distance from the fixation point. After a few points were plotted, all other points fell about the same distance from the center, and the examiner could usually surmise fairly accurately when the patient was going to see the test object. There was no tendency to concentric decrease of the fields on prolonged examination, a finding usually referred to as spiral fields. Although some books on perimetry mention this characteristic as observed in hysteria, Peter¹ and Traquair² carefully explain that spiral fields are seen in neurasthenia and not in hysteria. This observation has been constant in the cases being reported and helped establish these individuals as true hysterics and not as neurasthenics.

Secondly, little or no change occurred in the size of the field as the size of the test object was increased. In many of the cases the test object was increased from 4 mm. to a square of white paper four inches on edge, but the visual fields were unaltered. In cases 10 and 14 (table 1) where a 2- to 4-degree field was present,

this extreme constriction persisted even when a sheet of white typewriter paper was used, a rather dramatic observation. This finding shows the steepness of the field margins that is marked in hysteria. Organic lesions rarely show this. In the small group reported here, this steepness of the field margins has been consistent and deserves further emphasis in describing the typical field changes in hysteria.

Visual fields after suggestion. In all but three of the cases the visual fields remained about the same after suggestion. In the three who presented alterations the changes indicated an increase in the size of the field to about 30 or 40 degrees; thus the field was larger than originally but still constricted. The circular contour and steep edges remained.

Near vision. In about half of the cases the near-vision, results as tested with the Jaeger chart did not correlate with the distance vision. In six instances (40 percent), Jaeger 1 was read, usually with ease, although distance vision was 20/100 or 20/200. Apparently the patients had no insight into the inconsistency of this finding and once more malingering came to mind.

DISCUSSION

An interesting group of 15 cases of hysterical amblyopia was reported by Halpern³ while stationed at a preëmbarkation camp. In these instances the amblyopia developed acutely while the individuals were awaiting overseas duty, and all improved on hospitalization without any specific therapy. The vision was usually 20/100 or 20/200, with extremes of 20/60 and 10/400. The majority gave no previous ocular history. The fields were usually tubular and below 20 degrees, but in two cases no field changes were found. Pupillary and corneal reflexes were usually normal, and no marked refractive errors were present.

Mahoney and Linhart⁴ observed 13

TABLE 1
EYE FINDINGS IN 15 CASES OF HYSTERICAL AMBLYOPIA

Case	Age years	Maximum Corrected Vision		Visual Fields	Other Findings
		First Examination	After Suggestion		
1	36	O.D. 20/70 O.S. 20/70	O.D. 20/30 O.S. 20/30	15', tubular	None
2	24	O.D. 20/100 O.S. 20/100	O.D. 20/40 O.S. 20/40	8', tubular	Myopia (3D)
3	33	O.D. 20/100 O.S. 20/100	O.D. 20/30 O.S. 20/30	10', tubular	Myopia (2D); Jaeger 1 read easily
4	21	O.D. fingers O.S. 20/200	O.D. fingers O.S. 20/20	8', tubular	Convergent strabismus right, with amblyopia; Jaeger 1 read easily
5	39	O.D. 20/100 O.S. 20/100	O.D. 20/30 O.S. 20/30	15', tubular	Myopia (1D); Jaeger 1 read easily
6	21	O.D. 20/100 O.S. 20/200	O.D. 20/30 O.S. 20/50	20', not tubular, but not proportionate for distance	Alternating esotropia; Jaeger 1 read easily
7	21	O.D. 20/100 O.S. 20/200	O.D. 20/30 O.S. 20/50	10', tubular	Compound hyperopic astigmatism, moderate
8	20	O.D. 20/200 O.S. 20/200	O.S. 20/30 O.S. 20/30	10', tubular	Fields not tubular after suggestion
9	31	O.D. 20/100 O.S. 20/70	O.D. 20/40 O.S. 20/30	15', tubular	None
10	37	O.D. 20/70 O.S. 20/20	O.D. 20/30 O.S. 20/20	2', tubular (right); 4', tubular (left)	Myopia (2D); 30' fields after suggestion
11	22	O.D. 20/100 O.S. 20/100	O.D. 20/40 O.S. 20/40	10', tubular	Hyperopia (7D); Jaeger 1 read with effort
12	26	O.D. 20/70 O.S. Light perception	O.D. 20/20 O.S. Light perception	10', tubular	High mixed astigmatism, O.S., with amblyopia
13	26	O.D. 20/100 O.S. 20/100	O.D. 20/100 O.S. 20/100	8', tubular	Bilateral mixed astigmatism, moderate
14	25	O.D. 20/100 O.S. 20/200	O.D. 20/30 O.S. 20/40	2', tubular	Jaeger 1 read easily
15	25	O.D. 20/30 O.S. Light perception	O.D. 20/30 O.S. Light perception	10', tubular	Divergent strabismus, left, with amblyopia; Jaeger 1 read easily

instances of this condition among servicemen. The amblyopia was bilateral in all but one instance. These cases were more chronic than in Halpern's series but of milder degree, with corrected vision usually between 20/40 and 20/100. Fields were typical. In this group life-long histories of poor vision were the rule, and

most were emotionally immature, with poor intellectual endowments. These soldiers were similar to the ones reported in this paper.

Nature of hysterical amblyopia. Moersch⁵ has succinctly described this as "that convenient curtain that shuts out unpleasant experiences from visual mem-

ory." In 1930 Spaeth⁶ presented an excellent review of hysterical amblyopia and its background. He explained that the hysterical make-up from the standpoint of personality defects was manifested by a poor synthesis of the personality. This made it possible for certain groups of ideas to drop from an effective association with the main portions of the personality and to occupy a region first called and explained by Janet⁷ as the "subconscious."

Hysterical anxiety with conversion phenomena is the manifestation of a higher psychologic mechanism, and generally represents an unconscious wish. When situations of extreme difficulty arise there are but two alternatives—fight or flight. However, according to Janet's theory, an hysterically constituted person may develop a compromise situation between instinctive cravings and what external reality permits. He does this by taking on some bodily incapacity as a legitimate excuse for abandoning the struggle and thereby squaring his own conscience. It is thus a flight from reality or a "flight into sickness." Such a reaction represents a partial break in mental control; that is, a shutting off of recognition by the psyche of some organic function. In hysterical amblyopia this would be the inability to see, although the eyes anatomically are capable of vision.

The hysterical conduct may be infantile and ineffectual but it represents that particular person's most efficient way of meeting and adjusting to a situation. As Freud⁸ has shown, repression is the fundamental factor and the basis of hysterical manifestations. These individuals suffer from reminiscences, and their symptoms are the remnants of certain experiences. They have driven these experiences out of consciousness and out of memory, in this way saving themselves a great amount of psychic pain. However, they still exist in the subconscious only wait-

ing for their chance to become active and finally succeed in sending into consciousness a distinct but unrecognizable form of the repressed idea—which is the symptom.

Wechsler⁹ in his "Textbook of clinical neurology" explains that there is hardly a sign or symptom of organic disease which hysteria cannot simulate. It is the most protean disease in the whole domain of medicine.

Monosymptomatic hysteria is not at all uncommon, but the greatest number of cases present a variety of manifestations.

In this group, the predominant symptom was poor vision, but on going further into the history the psychiatrists uncovered other complaints and findings which fitted into the picture of hysteria. The majority, therefore, were not monosymptomatic but presented multiple symptoms.

For convenience, the hysterical amblyopias have been divided into three broad groups: 1. Acute—the amblyopia develops suddenly, and the course is usually short. 2. Chronic—the condition has existed for some considerable time, does not have a definite time of onset, and the course may be complex. 3. Mixed—in addition to hysterical amblyopia, other elements of psychoneurosis or neurasthenia are also present and frequently are the more obvious factors in the individual.

The more common ocular findings in hysteria as described by Head¹⁰ are amblyopia, photophobia, corneal anesthesia, ptosis, blepharospasm, diplopia, lacrimation, and intermittent attacks of blindness. Most of the cases in this report belonged to either the chronic or mixed category, and the outstanding finding was the amblyopia.

What is accomplished by suggestion?
It is generally agreed that suggestion is the most important factor in the treatment of hysteria,^{7, 8, 9, 11} and this holds true in

the case of hysterical amblyopia as well. Earlier in the paper the method of suggestion used in these cases was outlined briefly. It was felt that these individuals could not adjust to their setup in service, although no severe difficulty had been encountered previously in civilian life. Basically the line of suggestion employed emphasized that because of the present poor vision they could not be discharged or "separated" from the Army. Hope was maintained by suggesting another examination after "resting the eyes."

The hysterical amblyopia probably had developed because the individual could not get along in service although he did not realize or admit this in his consciousness. Now the defective vision, which was the soldier's method of adjustment to the Army, however inadequate, was resulting in his remaining in service. Obviously the symptom (amblyopia) was no longer serving the desired purpose, and so vision was regained.

The suggestion was brief and the explanation of the resulting mental process crude but probably near the truth in most instances. The belief that the underlying factor in these cases of hysterical amblyopia was the inability of the soldier to adapt to the Army was assumed, and may not have been the cause at all in some of these individuals. Thus in case 13 no improvement in vision was obtained after suggestion, so that perhaps the Army was not his difficulty and discharge was not the remedy.

Since hysterical amblyopia is rare in civilian life,* especially in males, whereas it is relatively frequent among those in service, it is probable that factors in Army life are the important cause of hysteria.

Although the improvement in vision obtained in this series after suggestion was probably only transient and by no means

a cure, this finding aided in the diagnosis of the condition. It also helped in establishing the fact that the individual was capable of good vision and removed the element of doubt and error which always should be in the mind of the examiner in making the diagnosis of a functional condition.

Differentiation between hysterical amblyopia and malingering. Moersch⁵ emphasizes the point that although "hysteria is used frequently in place of malingering, the two terms are not at all synonymous." However, the diagnosis of malingering is frequently difficult and in service becomes an especially inviting pitfall. As stated by Shelton,¹² "the examination of the malingerer becomes a battle of wits, and he may make you feel that your years of special training were spent in a kindergarten."

Fundamentally, the hysterical person is largely if not wholly unconscious of the unreality of his symptoms. He deceives himself and others without design or malice, often without demonstrable motive, although this exists. The malingerer, on the other hand, deceives willfully and knowingly; he realizes the falseness of his complaints and findings. Both the malingerer and the hysteric are frequently of poor emotional and psychiatric quality, however, and the examiner may be hard put to distinguish the two.

The malingerer may have symptoms of hysteria, and hysterics may simulate. Trapping a patient with amblyopia into seeing is not proof of malingering. Trickery may suddenly arouse attention in hysteria, and therewith sensation. The differentiation between the two conditions can be made, however, and is of the utmost importance, since the treatment and handling of such patients depends upon the diagnosis. Several factors will aid in differentiation and when assembled will lead to the correct diagnosis:

* Wechsler states that he has rarely encountered hysterical amblyopia in civilian practice.

1. The hysteric is indifferent and nonchalant in regard to his ailments and does not seem particularly upset about the amblyopia. The malingerer, conversely, is worried about his condition; frequently, too much so.

2. In hysterical amblyopia the subject has no difficulty in getting about and rarely bumps into objects or hurts himself, even though his fields may be markedly constricted. The malingerer, however, is "blinder than blind," often completely helpless. Eggers's¹³ description is characteristic of their "sometimes affecting difficulty in walking about in dim illumination although the peripheral fields were normal. Invariably they overplayed their part."

3. While the hysteric revels in examination, no matter how long or how often repeated, the malingerer loathes this, is sulky, resentful, and not coöperative.

4. In hysteria the amblyopia is usually bilateral, in the malingerer more frequently unilateral.

5. Varying degrees of visual acuity obtained through "trick tests" is uncommon in hysteria, whereas frequent and very suggestive in malingering. Again, though, these so-called malingering tests should not be the sole basis for differentiation, since hysteria will give positive results in some instances. The person with true hysteria may respond to these tests in the same manner as the simulator.

6. The results of the peripheral-field examination are outstanding and characteristic in hysteria. The tubular, concentric field with steep borders, proved by constancy with varying-sized test objects, and often showing a reversal of color fields, are usually diagnostic of hysteria. With these findings the burden of proof rests on the examiner to disprove hysterical amblyopia and to diagnose malingering. Few malingerers can deceive intelligently on fields.

Of the 15 cases of hysterical amblyopia reported here, none was diagnosed as such before referral to the Separation Center. This was more probably due to the omission of perimetric examination than to any other single factor. In several instances, before the correct diagnosis was made, the possibility of malingering was strongly present in the mind of the examiner, especially when "trick test" results such as reading Jaeger 1 with 20/200 corrected distance vision were obtained. It was only after the complete data were assembled that the tentative impression of malingering could be shown to be false. There have been ocular malingerers at the Separation Center, but these have been rare compared with the occurrence of hysterical amblyopia.

It may be said that a tentative diagnosis of hysterical amblyopia should be strongly considered in an individual with bilateral amblyopia and no organic findings who previously has had good vision.

Evaluation of disability. These soldiers with hysterical amblyopia have filed claims with the Veterans' Administration, and the problem arises of evaluating the amount of existing disability. I do not believe any of this group were familiar with disability ratings. Many would not have filed claims except that they were urged to do so because of possible disability.

In the United States Veterans' Administration "Schedule for disabilities," March, 1933, maximum vision of 20/200 in each eye (such as in case 8) is entitled to 60 percent disability; 20/200 in one eye and 20/100 in the other to 50 percent disability (cases 2, 3, 5, 11, 13), and so forth, depending on the vision. No mention is made as to whether the cause of the poor vision is organic or functional as long as certain requirements as to the methods of testing are fulfilled.

On page 40 in the "Schedule for disabilities" certain disability ratings are

listed for diminution in the peripheral visual fields. Thus, bilateral concentric contraction of the fields to 10 to 30 degrees is judged to be a 40-percent disability, whereas contraction to less than 10 degrees in each eye is ruled a 100-percent disability. However, this table has a note which wisely states that "demonstrable organic pathology commensurate with functional loss will be required," and that "ratings for functional contraction or field losses will not exceed ratings for hysteria."

Reference to disability compensation for hysteria groups this condition with other types of psychoneurosis. Five groups are distinguished, depending upon the amount of subjective and objective symptomatology and the amount of social and industrial incapacity. The determination of ratings is dependent upon difficulty in the veteran's economic adjustment; that is, impairment of earning capacity. The type of disorder, severity, persistence, and continuity of the symptoms are also considered.* Disability ratings for

the designated five classes of psychoneurosis are 0 percent, 10 percent, 30 percent, 50 percent, and 80 percent.

Since the ocular findings in these cases are only a manifestation of hysteria and not due to any demonstrable pathologic process in the eyes, the disability ratings should be on the basis of the severity of the hysteria.

CONCLUSIONS

1. Fifteen cases of hysterical amblyopia were observed at the Separation Center at Fort Snelling, Minnesota. This was an incidence of 1.03 percent among those discharged for organic or mental disability.

2. The testing of peripheral visual fields was the most important aid in the attempt to arrive at the diagnosis.

3. Differentiation between hysterical amblyopia and malingering is usually possible and should be made, since the treatment and handling of the patient is dependent on the correct diagnosis.

4. Disability ratings in hysterical amblyopia should be based on the severity of the hysteria and not on the amount of visual or field loss.

44 Pearl Street.

* Manual for Medical Examiners of the Veterans' Administration, January, 1940.

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NOTES, CASES, INSTRUMENTS

ACCESSORY LACRIMAL GLAND ON THE CORNEA

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The occurrence in man of a corneal tumor composed solely of glandular tissue entirely analogous to that of the lacrimal gland has not, so far as is known, been previously reported in the literature. Under the circumstances the findings in such a case, recently encountered, are deemed worthy of record.

A private, U. S. Army, colored, aged 28 years, was admitted to a General Hospital with the complaint of "poor sight

The blood, urine, and spinal-fluid examinations and X-ray studies of the orbit and skull were normal. The stool examination revealed mild ankylostomiasis.

The eyes were normal except as noted. The right eye presented (figs. 1, 2) a pink, nonbleeding, soft tumor, 8 by 8.5 by 3 mm., of which 2.5 mm. extended over the bulbar conjunctiva, centering in the 7-o'clock position and 6 mm. over the cornea. The entire mass was covered with glistening, nonvascularized epithelium, and was firmly adherent to the cornea. Two small arterial loops, with accompanying venous drainage, were present at the 6:30- and 7:30-o'clock positions, issu-



Figs. 1, 2, 6 (Dame). Clinical appearance of accessory lacrimal gland on the cornea. Fig. 1, The tumor and its vascular supply. Fig. 2, Partial concealment of tumor by lower lid. Fig. 6, Postoperative appearance of the eye.

due to the lump on my right eye." This "lump" had first been noticed in 1928, when he was 13 years old, at which time it was concealed by the lower lid. It had been completely asymptomatic until the past five years, when a slight but progressive impairment of vision had developed. Six months before this hospital admission minor "tear-gas" stimulation had occurred, which he believed had resulted in a mild residual excess lacrimation of the right eye.

The physical examination, other than of the eyes, was negative for any evidences of hereditary, developmental, or acquired changes of a pathologic nature.

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ing from the bulbar conjunctiva. Superior and parallel to the upper edge of the tumor, and separated from it by 1 mm. of clear cornea, was an arcuate corneal opacity, 1 by 8 mm. in size, resembling arcus senilis, with incorporated pigment which appeared to consist of melanin granules. The cornea measured 13 mm. horizontally and 13.5 mm. vertically. The pupil of the right eye measured 6 mm., that of the left 5 mm., becoming 4 mm. and 3 mm., respectively, on stimulation with a flashlight. The vision was: O.D. 20/200 and J8 improved to 20/70 and J5 by a +.50D. sph. \approx -2.00D. cyl. ax. 85°; O.S. 20/50 and J3 improved to 20/30 and J2 by a -1.00D. sph. \approx -.50D. cyl. ax. 90° (full homatropine cy-

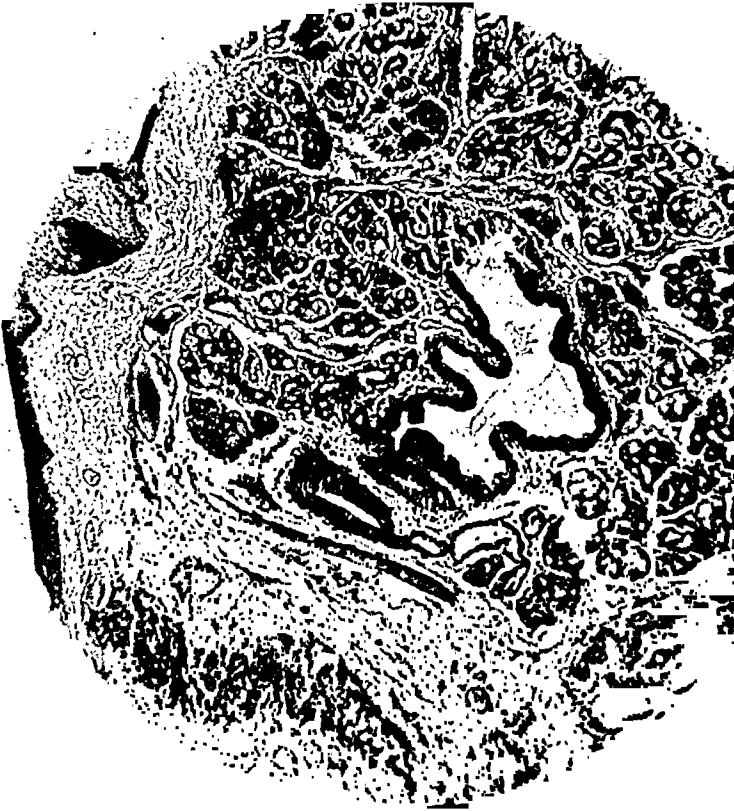


Fig. 3 (Dame). Low-power photomicrograph, showing race-mose structure and duct of accessory lacrimal gland on cornea. (Museum and Medical Arts service, Neg. D4317, U. S. Army Medical Museum.)

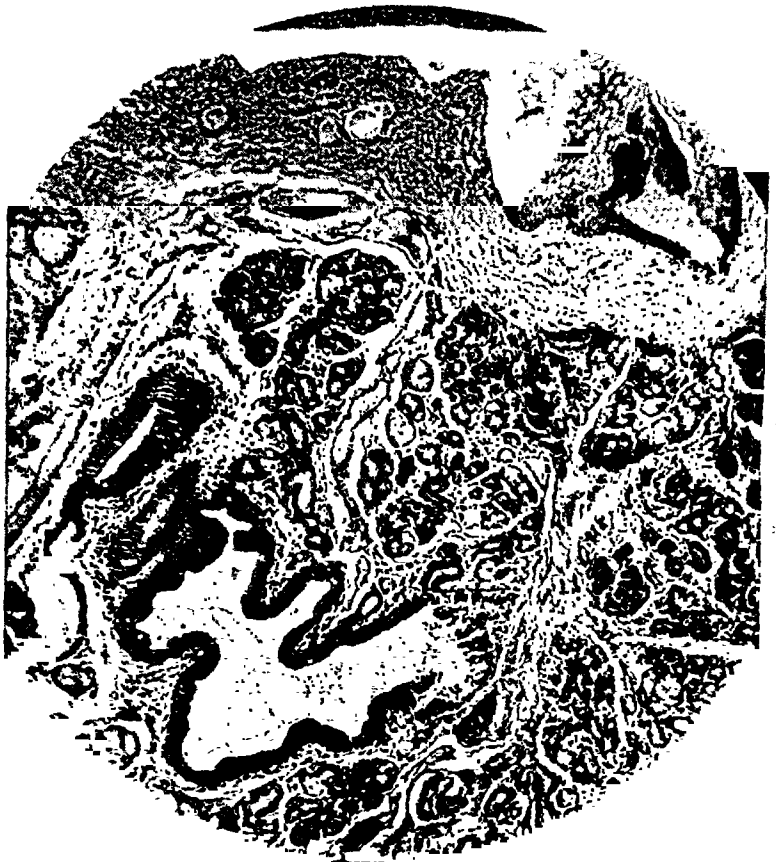


Fig. 4 (Dame). Medium-power photomicrograph, showing collecting tubules and main duct of accessory lacrimal gland on the cornea. (Museum and Medical Arts Service, Neg. D4317, U. S. Army Medical Museum.)

cloplegia). Color confusion in the right eye was present to both Ishihara plates and colored yarns. The visual field was contracted (3/330/wh/9 C. P.) to an irregular 30-degree field. The left eye was normal except for an equal amount of

ture (figs. 3, 4, 5) resembling normal lacrimal tissue.

The *pathologic report* of the tissue (Major J. H. Bragdon) was as follows: "The specimen consists of a small soft fragment of grey-pink tissue 4 by 2 by 2



Fig. 5 (Dame). High-power magnification of racemose structure and duct of accessory lacrimal gland on cornea. (Museum and Medical Arts Service, Neg. D4317, U. S. Army Medical Museum.)

megalocornea, the refractive error as noted, and a 15-degree visual-field contraction.

The tumor was removed without incident by scissor dissection under procain anesthesia. Microscopic examination revealed 80 percent of the tumor to be of normal-appearing tubulo-acinous struc-

ture, one surface of which appears to be epithelized.

"Microscopic section shows well-formed acini of what is apparently a functioning lacrimal gland. In some sections the excretory duct is seen. The gland is surrounded by a loose connective tissue, which, in turn, is covered by stratified

squamous epithelium. There is no evidence of inflammation or of tumor. *Diagnosis:* Ectopic lacrimal gland."

Convalescence was uneventful, and the cornea healed well with an opacity (fig. 6). The tear production was 20 mm. for the right and 18 mm. for the left eye during a five-minute period, on red litmus-paper strips. Fluorescein appeared on the floor of each nostril in 10 minutes. The patient was returned to the United States because of poor vision.

The embryologic background for the development of anomalies of the orbit and its contents, including accessory lacrimal glands, has been adequately summarized

elsewhere.^{1, 2} Accessory lacrimal glands have been reported in many intraorbital locations, but this is, so far as is known, the first tubulo-acinous structure involving the cornea.

SUMMARY

The occurrence of a corneal tumor, composed solely of tubulo-acinous glandular tissue entirely analogous to that of the lacrimal gland, is reported and, so far as is known, for the first time. Photographs of the eye and photomicrographs of the tumor structure are included.

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HERPES ZOSTER OPHTHALMICUS WITH VARIED COMPLICATIONS

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Although herpes zoster ophthalmicus is a rare disease, the literature contains a voluminous record of its course and of many of the conditions that arise in conjunction with it. Recently, Edgerton* described comprehensively the salient factors of the disease and its complications.

There has recently come under my care, however, a case which, because of its extremely unusual variety of complications, merits report. The sequence of conditions that occurred is as follows: acute herpes zoster ophthalmicus, non-ulcerative keratitis with iritis, complete external ophthalmoplegia with ptosis, ex-

ophthalmos, and finally, several months later, violent iridocyclitis. Such a variegated list of complications involved almost every part of the eyeball with the exception of the optic nerve, and demonstrated how extensively this disease may damage the globe and its adnexa. The globe has been reported as being involved in approximately 50 percent of the cases of herpes zoster ophthalmicus and the cornea in about 33⅓ percent of such cases. In the case to be described, corneal involvement occurred during the second week and manifested itself as a subepithelial group of round punctate gray dots 2 to 3 mm. in diameter and some even larger, which were located near the limbus and extended upward toward the central cornea from the 5- to the 9-o'clock position. The corneal epithelium did not become stained with fluorescein, but several folds in Descemet's membrane were present and the cornea showed diffuse edema. This

* Edgerton, A. E. Arch of Ophth., 1945, v. 34, July, pp. 40-62; August, pp. 114-153.

condition subsided after four weeks' progress of the disease, leaving permanent gray corneal opacities scattered throughout the affected area. Considerable iritis was present during the course of this complication, with sharp pain, and this involvement subsided in conjunction with the keratitis.

During the prodromal and acute vesicular stages of the eruption, there occurred extensive edema of the upper lid and less of the lower lid, with almost complete closure of the eyelids. During the eighth week of the disease, however, this edema had largely disappeared, when suddenly the patient noted diplopia with inability to raise the upper lid. In a few days there occurred gradually increasing proptosis of the eyeball with limitation of motion in all directions of gaze. The Hertel exophthalmometer revealed 5 mm. of exophthalmos. This complication of the disease lasted for eight weeks. Its cause has been ascribed to excitation of the sympathetic fibers of the superior cervical ganglion or to muscle atony when it is accompanied by oculomotor-nerve paralysis. Another explanation attributes the proptosis to extraocular-muscle paralysis due to thrombophlebitis within the muscle tissue. The complication of exophthalmos occurring in the course of herpes zoster ophthalmicus is rather rare and has been recorded only a few times; in my case the exophthalmos and muscle paralysis lasted for eight weeks, with muscle function slowly and gradually returning accompanied by recession of the exophthalmos. The complication of the ocular-muscle paralysis occurring during the course of this disease has been reported in percentages varying from 7 to 24 of all cases; in the case under discussion the oculomotor paralysis occurred during the eighth week of the disease, and a substantial lapse of time took place between its onset and the subsidence of the skin lesions.

However, the literature reveals that muscle paralyses do occur at varying intervals during the course of the disease; some investigators have reported paralysis occurring even prior to the cutaneous eruption. In my case, the 3d, 4th, and 6th cranial nerves were involved, and the return of function to the affected muscles was a slow procedure involving 2 to 3 months' time; the muscle abnormality definitely outlasted the exophthalmos, and there was quite definite partial external ophthalmoplegia and ptosis when the exophthalmos had completely receded. This residual paresis completely disappeared within an additional month and ocular motility was then normal, although elevation of the upper lid was somewhat less than normal. The manner in which the ocular-muscle paresis occurs has been attributed to extension of the infectious process to the motor branches of the nerve as it passes into the superior orbital fissure; other theories have attributed the process to an involvement of an associated basal meningitis with nuclear lesions and resultant muscle dysfunction. As previously stated, according to a third theory such muscle paresis results from intramuscular hemorrhages following a thrombophlebitis. These ideas seem to be somewhat in the realm of conjecture, especially in the absence of positive spinal-fluid findings, but in a few cases spinal-fluid examination has revealed a lymphocytosis and occasionally a leucocytosis. These findings would corroborate the extension of the disease to the meninges. From an anatomic and pathologic point of view it would seem that a "spilling over" of the infectious process from sensory to motor branches would be a more logical explanation, in as much as the first branch of the 5th nerve sends out sensory ramifications to all the motor nerves of the eye before it enters the orbit. It is usual for the muscle paralysis to

clear up completely, although, as has been stated, the required length of time varies greatly.

One of the most interesting phases of the case under discussion was the appearance of an extremely severe iridocyclitis nine months following the onset of the disease and following a period of three months during which the patient had been symptom free with the exception of an occasional attack of neuralgia over the affected scalp area. During the early weeks of the disease the iris had shown signs of congestion with one stromal hemorrhage, but this condition subsided following the healing of the keratitis; then, at a time when the patient was apparently well on the way to recovery, there suddenly occurred severe pain, photophobia, and blurring of vision with descemetitis and vitreous opacities. This sequence has been reported previously, but it is relatively rare as such a late complication. The usual symptoms of iridocyclitis were magnified to such a degree together with the appearance of an hypopyon 2 mm. in depth that hospitalization was again required and three weeks of intensive care were necessary before relief was obtained. Atrophy of the iris of moderate degree resulted together with a slight amount of enophthalmos. Two months following the onset of this complication the eye was again quiet and has remained so up to this date (14 months following the onset of the disease). After such a series of complications involving so many parts of the eye, the vision was, of course, substantially impaired, owing to corneal opacities and global shrinkage.

This course of events exemplifies the manner in which this disease may affect an apparently healthy person and the extremely severe damage that it may inflict upon the eyeball.

Case report. Mrs. A. D., aged 54 years, a white American housewife, was first

seen 48 hours following the onset of severe pain in and around the right eye. At this time there were moderate edema and redness of both eyelids with very definite ciliary congestion of the eyeball. The cornea was slightly hazy; pupillary reaction was normal, and the media and fundus were normal. The temperature was 99.2°F., pulse 82, respirations 24. The red blood count was 4,900,000; white blood count 9,200. The patient was extremely obese; physical examination was negative. A definite diagnosis could not be made at this time, but the possibilities of herpes zoster ophthalmicus and erysipelas were considered. Symptomatic treatment for the pain was given. The neuralgia became increasingly severe during the next two days, requiring vigorous sedation, and when the patient was next seen, three days later, the typical skin vesicles were present, extending down to the tip of the nose, involving the eyelids and the right half of the scalp but sharply demarcated at mid-line. The diagnosis was obvious, and treatment was instituted to control the symptoms; no convalescent serum was available.

One week following the onset of the disease, the cornea showed subepithelial punctate deposits which were accompanied by diffuse epithelial bedewing. There was no stain with fluorescein at any time. The pupil was widely dilated with atropine, and the corneal involvement lasted for approximately four weeks, gradually subsiding, but the residual opacities remained as previously described.

During the next weeks the neuralgic pains became somewhat less severe, but the globe remained considerably congested, with moderate edema of the eyelids. The eye remained more or less in this condition until the eighth week of the disease, when diplopia was noted by the patient, and there occurred complete external oph-

thalmoplegia accompanied by proptosis of the eyeball, which took place within five days. This condition, which resulted in 5 mm. of exophthalmos, was unchanged during the ensuing month. Following this period some degree of ocular motility was regained. Muscle function gradually increased, and, following a period of eight weeks, ocular motion was again normal, although there was still present a slight amount of exophthalmos with some ptosis of the upper lid. These conditions returned to normal within another two-week period.

The patient now felt much more comfortable and was practically symptom free for a period of three months. However, nine months following the onset of the original symptoms, there suddenly occurred extreme photophobia with tearing and further loss of vision, and there took place a typical attack of violent iridocyclitis. This required hospitalization of the patient, in an attempt to curb these developments with typhoid-vaccine therapy. Following the initial dose of typhoid, however, a severe tachycardia resulted and medical consultants felt that in view of this condition, and the patient's obesity, further typhoid therapy would be inadvisable. Routine treatment with atropine was given, and after four weeks this condition improved greatly. This involvement occurred about 10½ months after the original appearance of herpes zoster ophthalmicus.

The vision in this eye previous to the disease was 20/20 corrected; following this series of complications the corrected vision is 20/100. The eye is now quiet, although there remains some redness and slight edema of both lids, and a somewhat pronounced corneal leukoma extending 2 to 3 mm. upward from the limbus from the 5- to the 9-o'clock position. The skin eruptions have resulted in scarring throughout the affected area. The patient

has an occasional severe neuralgic pain, especially upon exposure to cold, and the eyeball has become somewhat atrophic owing to the severe iridocyclitis.

Such a variety of complications occurring during such an unusually long lapse of time demonstrates very vividly the manner in which this stubborn infectious process may involve most of the important parts of the eye with resultant impairment of their function.

520 Commonwealth Avenue.

A SIMPLE METHOD FOR THE EXACT MEASUREMENT AND PLACEMENT OF RECESSION SUTURES

HENRY G. WINCOR, M.D.
New York

The success or failure of a muscle operation is dependent on the exact amount of resection or recession.

In the accepted technique of applying the calipers to find the scleral point for new insertion, one is faced with the problem of exactly what points are to be considered as the anatomic insertion. One point seems to be well agreed upon; that is, that the medial rectus is inserted 5.5 mm. from the limbus. According to Whitnall, the measurements made by Fuchs (1884) were taken from the largest series of eyes and are most widely accepted.* His figure is also 5.5 mm. While the lines of insertion of the muscles are not perfectly straight, still those of the medial and lateral recti are most nearly so. The line of insertion of the medial rectus is straight, or slightly convex forward.

The recti insert by means of "thin, flat glistening tendons, formed by parallel rectilinear fasciculi of connective tissue, without anastomoses, but weakly united

* Whitnall, S. E., *Anatomy of the human orbit*. Oxford Edition, p. 266.

by transversely placed and easily separable fibres. Some of the fasciculi leave the main layer to be inserted separately as far back as 1 to 5 mm. behind the remainder of the tendon fibres." Consequently, after the muscle is cut from its insertion and the operator looks down on the stump, he is faced with a picture of thinned, indefinitely inserted fasciculi anteriorly, blending intimately with, and almost indistinguishable from, the superficial fascia bulbi and even superficial scleral fibers. Posteriorly, as has been pointed out, the stump ends indefinitely as far back as 5 mm.¹ Of course, the experienced eye surgeon will pick that point which, in his opinion, is the true insertion of the muscle.

The method I wish to suggest is to pick a much more distinct point to start from; namely, the limbus of the cornea. As has been explained, since the distance of insertion of the medial rectus is quite uniformly 5.5 mm. from the limbus, this distance, plus the amount of recession to be done, can be measured from the limbus. It is best to use the exact horizontal meridian of the limbus to measure from, and extend the scleral point of identification straight up and down, and pick points along this line corresponding to the width of the tendon, if one wants to spread the muscles properly. I suggest the 9:00-o'clock position and the drawing of the straight vertical line with the calipers.

To avoid injury to the cornea from the sharp points of the calipers, the points may be filed smooth and round.

Modification of the recession operation.

1. The internal rectus is exposed and picked up on the muscle hook. 2. A single-needle catgut suture is whipped around the upper border of the muscle close to the muscle hook, and the suture is locked to prevent slipping. 3. A similar suture is applied at the lower border. A small suture clip is applied to the ends of each suture.

4. The assistant lifts up the two catgut sutures vertically, putting the tissues on tension. 5. The muscle is severed close to its attachment. 6. While the assistant still holds the two catgut strands, a third catgut suture is whipped around the cut edge of the muscle at its center and locked. 7. A pair of calipers set at 10 mm. is applied to the eye from the corneal limbus to the sclera on the horizontal meridian. This provides absolute measurement for muscle recession. 8. The central catgut suture is now applied to the sclera at the central caliper marking. 9. The upper and lower catgut sutures are applied vertically above and below this central point. 10. The central suture is now tied; the upper and lower sutures are similarly tied. This procedure presents three sutures in line, giving added strength to the muscle attachment. 11. The caliper measurement is absolute and does not vary as it would in measuring ordinarily from the muscle stump. 12. The conjunctiva is sewed with continuous silk.

SUMMARY

1. In order to recess a muscle more accurately, it is suggested that one measure from the limbus rather than from the original muscle insertion, adding the amount of recession desired to the normal anatomic measurements between limbus and original insertion.

2. The recession operation is simplified, eliminating the use of the muscle forceps, which traumatizes the muscle and introduces an error of 1 mm.

1882 Grand Concourse.

A NEW TYPE OF SURGICAL PEG

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Martinsburg, West Virginia

Those who have done any amount of plastic surgery have been bedeviled at one

time or another by the rubber pegs used to prevent sutures from cutting through tissues. Especially in these days it is hard to get the proper type of rubber. Often the pegs dig into the tissues and macerate the skin. Passing sutures through a tiny square of rubber is, moreover, a nuisance, is time consuming, and requires the help of an assistant.

After some experimenting with various methods and materials, the following technique was evolved which has proved very satisfactory:

A rectangle of oiled silk, measuring $2\frac{1}{4}$ by 4 inches, is carefully folded into three thicknesses along its length, giving a triple fold of oiled silk measuring $\frac{3}{4}$ by 4 inches. It is then stitched on a sewing machine along the border which does not have the free edge. This stitching is placed one-fourth inch from the edge. It is kept in 70-percent alcohol until ready for use.

When needed, the needles are passed through the stitched edge easily and rapidly and a peg of any desired size is cut

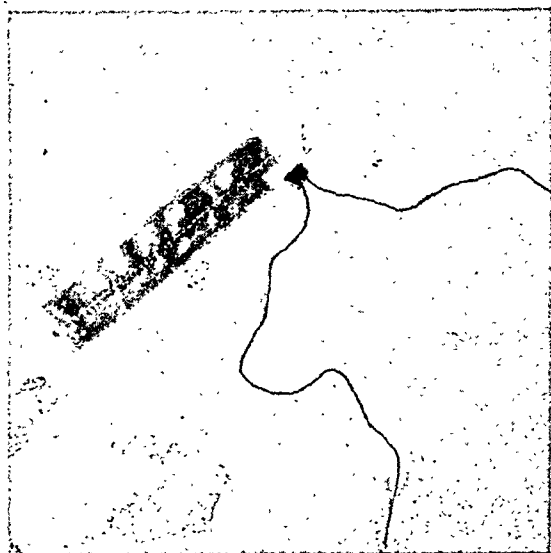


Fig. 1 (Fox). New type of surgical peg.

from the whole piece (fig. 1). The same can be done after the needles have been passed through tissues. One such piece of oiled silk suffices for 12 to 16 pegs, depending on the size desired. These pegs are soft enough so that they do not macerate the skin and sufficiently firm to prevent cutting the tissues.

Newton D. Baker General Hospital.

SOCIETY PROCEEDINGS

EDITED BY DR. DONALD J. LYLE

COLORADO OPHTHALMOLOGICAL SOCIETY

January 20, 1945

DR. GUY HOPKINS, *president*

NEW INJURY, DIPLOPIA FROM OLD INJURY

DR. WILLIAM H. CRISP reported a medico-legal case in which an injury had occurred to the right eye on January 22, 1944. The left ocular adnexa of this patient had been injured 18 years before. The recent injury was caused when the blade of a heater fan came loose and struck the right side of the patient's face, cutting the nose and upper eyelid. The patient, aged 23 years, was a truck driver. Unfortunately, no written record of the case had been made at, or shortly after, the time of the recent injury, but the broad statement was made that, when seen by an ophthalmologist three days after the injury, the right eye showed vitreous opacity, interpreted as due to hemorrhage. When first seen by Dr. Crisp, on June 1, 1944, the right eye was entirely quiet and appeared to be normal with the exception of a dense web of vitreous opacity through which, when the pupil was dilated, many details of the fundus could be seen rather clearly. This eye was almost without refractive error, and had shown vision (under cycloplegia) varying between 20/24 and 20/60, more frequently the latter. The movements of this eye seemed normal. Although there had been a limited cut in the upper eyelid, the eyeball itself showed no appearance attributable to injury except the vitreous web.

Since the recent injury, the patient had complained of double vision. The lower rim of the left orbit showed a marked

displacement, due to fracture of the malar bone, with decided depression of the inner fragment, considerable displacement of the whole orbital floor downward, and a markedly lower position of this eye in relation to the right eye. The left eye had two diopters of mixed astigmatism, correction of which gave vision of only 20/50, although the internal ocular structures seemed normal, and there was no corneal nor scleral scar.

It seemed likely that, for many years, the right eye had been the better eye, and that the left eye had been practically ignored until the injury to the right side of the face. The Maddox-rod test showed from 3.5 to 7 centrads of right hyperphoria and 12 centrads of exophoria. There was crossed diplopia, and the images tilted away from one another at the upper ends. The records obtainable did not altogether exclude the possibility that the web of vitreous opacity might have existed prior to the injury of January 22, 1944. The patient was made more comfortable by wearing the astigmatic correction for the left eye, but he could not drive at night on account of disturbance by headlights. An opinion had been given that the visual loss from the recent injury should be based upon the present corrected vision of the right eye, without regard to the muscular imbalance.

CONGENITAL PTOSIS

DR. R. W. DANIELSON reported on a white child, aged 5 years. This child was first seen at the age of 17 months because of a ptosis of the right upper eyelid since birth. The upper-lid border was just below the center of the pupil. The lid would not elevate on looking up. This child was

seen by Drs. Bane, Sherwood, and Macomber, and surgical intervention was postponed.

On November 28, 1944, a Gifford and Puntenny modification of the Dickey operation was performed. On December 8th, there was a staining area on the cornea and severe entropion, the cilia rubbing on the cornea. A week later when considerable skin was removed from the upper lid, the entropion improved quite perceptibly. Five days after this, an ulceration of the cornea with hypopyon was treated with penicillin and sulfadiazine. On Christmas Day, the patient was much improved, and by December 29th, the hypopyon and ulceration had disappeared, although rather marked opacity remained. On January 1, 1945, the patient was provided with "moisture" glasses and was ordered to wear X-ray protective covering at night. On January 20th, the cornea showed faint stain. The lid elevated with the elevation of the eye and went down with the lowering of the eye. Palpebral fissures were about the same for each eye. It was noted that the right lid did not blink with facility and even seemed able to elevate slightly (a possible associated upturn of the eyes during winking).

INTERSTITIAL KERATITIS

DR. R. W. DANIELSON presented the case of Mr. G. L. The patient, first seen on February 25, 1944, had a history of getting a foreign body in his left eye two days previously. A case of iritis of the left eye was found; the right eye was normal. Vision was: O.D. 20/20-3; O.S. 20/40 (uncorrected). The patient was treated with atropine and typhoid vaccine. On March 1st, he was improved, but just one month later, he was worse, with K. P.'s and corneal opacity beginning. There was no improvement by June 1st. Major Chadwick prescribed 14 hours' treatment in the fever cabinet. On August

9th, when the patient was still unimproved, more typhoid treatments were given, and all suspicious teeth were removed. Sulfonamides were also given. Six weeks later the right eye showed slight circumcorneal redness, but nothing else. Riboflavin and Bicophs were prescribed. The report on October 13th was: right eye—bedewing; K. P.'s and corneal opacity. From November 1st to 5th, 2,000,000 Oxford units of penicillin were administered with no improvement whatsoever. On November 6th, the patient was inoculated with malaria. Two weeks later the malaria reactions started. After six, the reactions terminated spontaneously. The malaria is the only treatment which has seemed to control both the opacification of the cornea and the inflammation. The patient's present condition shows marked opacity of the substantia propria, with K. P.'s and vascularization of each eye. Vision is: O.D. perception of hand movements; O.S. 0.2 (corrected).

Associated facts in this case show that the patient was rejected from the Army because of arthritis. He had secondary syphilis in November, 1936, and had been treated with bismuth and arsenic since then. On August 7, 1944, the Kahn test showed 2+, but was negative on November 2d. The patient also has old pulmonary tuberculosis with strong tuberculin reaction. Both the father and mother had tuberculosis. A brother is supposed to have a corneal opacity of one eye of inflammatory origin. The conclusion was that this patient had interstitial keratitis with anterior uveitis, probably an acquired form, which was possibly aggravated by tuberculous infection.

CHRONIC PEMPHIGUS

DR. W. T. BRINTON reported on Mrs. H., aged 60 years. One-and-a-half years ago her eyelids became red and inflamed

and have been gradually getting worse since that time. She first noticed sore, red spots at the inner canthus of the right eye; soon the other eye became involved. All teeth were removed, and a diagnosis of trench mouth was made. The eyes became increasingly sensitive to light, the lid inflammation progressed, and vision gradually became poorer. In recent months, the patient was troubled with lashes of the lower lids turning in.

In this case, the palpebral and bulbar mucous membranes were markedly involved and showed bands of fibrous connective tissue with shrinkage of mucosa, tending to obliterate the cul-de-sacs. More recently, both corneas have become involved with pannuslike, vascular encroachments from the limbus which interfere with vision. There is secondary iritis, and xerosis is present. There are lesions of the mucous membrane of palate and lips as well as nose. She has been troubled with a vaginitis for two years. In the two years, she has lost 100 pounds in weight.

MONOCULAR MULTIPLE VISION

DR. F. NELSON reported on E. H., a white woman, aged 64 years. She was first seen on December 10, 1943, but had complained about multiple vision for five years. Diagnoses of cataract and glaucoma had been made on different occasions. The right eye had distinct monocular triple vision; the left eye, monocular double vision. There were supranuclear and cortical cataracts in both eyes. Tongue-shaped opacities, protruding from the periphery toward the pupillary area, were apparently causing prismatic apparitions. There were double focusing lenses in both eyes. The discs looked like glaucomatous excavations, but tension was never above 20 mm. Hg (Schiotz). Vision was: O.D. with a $-0.25D.$ sph. $\approx -2.00D.$ cyl. ax. 102° , $5/8$ partly,

and J1; O.S. with a $-0.50D.$ sph. $\approx +2.00D.$ cyl. ax. 175° , $5/8$ partly, and J1, at about 20 cm. distance. Additional plus correction did not improve near vision. A 1-percent pilocarpine solution, instilled once a day, completely eliminated multiple vision in both eyes. Refraction varied considerably, and vision deteriorated slightly during that year.

On October 18, 1944, this patient notified me that her left eye was losing vision rather rapidly in the lower part of the visual field. When she was examined on October 20th, the right eye showed no change, but the left eye had an almost total detachment of the retina, with extensive ragged tears in the upper temporal quadrant, apparently reaching almost into the posterior polar region. The detachment was operated on on October 23d, after temporary dissection of the upper and lower rectus muscles. Complete reattachment was achieved, with normal visual field for white and colored objects, but central vision deteriorated to $5/30$. Double focus in the lens of the left eye became much more pronounced, so that this eye could see about the same with a -5.00 and a $+8.00D.$ sph. The patient reads J2 with the left eye with only astigmatic correction of $+2.00D.$ cyl. ax. 180° . The diagnosis was monocular, multiple vision. Double focus lens, O.U. Refraction difference increasing after retinal detachment, O.S.

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

March 5, 1945

DR. MILTON L. BERLINER, *presiding*

SYMPOSIUM ON DIABETES

BIOMICROSCOPY OF THE DIABETIC EYE

DR. MILTON L. BERLINER presented

lantern slides illustrating some of the changes seen in the anterior ocular segment in diabetes by means of the biomicroscope.

HISTOPATHOLOGY OF THE EYE IN DIABETES

DR. LOUISE H. MEEKER presented lantern slides of histologic sections from eyes from diabetics showing various pathologic features.

DIABETIC RETINOPATHY

DR. HERMAN ELWYN said that diabetic retinitis, or retinopathy, is an easily recognizable ophthalmoscopic entity characterized by: (1) small, round, and irregular hemorrhages, situated mainly in the area between the upper and lower temporal vessels and in the region surrounding the optic-nerve head; (2) sharply defined or confluent white exudates in the deeper layers of the retina; and (3) yellowish-white glistening exudates varying in size from a pinpoint to large irregular masses. The small, round, and deep hemorrhages occur only in diabetes and constitute the most characteristic feature of diabetic retinitis. When the small white exudates and the glistening deposits are also seen, the complete picture of diabetic retinitis is present. This characteristic picture does not occur in any other disease.

The ophthalmoscopic picture is at times complicated by changes in the retinal vessels and their consequences, such as: aging, arteriosclerosis, contraction of small vessels, obstruction of a venous branch, and an episodal arteriospastic retinopathy. There is no causal relationship between these changes and those of diabetic retinitis. Some of the severe cases of diabetic retinitis are characterized by large retinal hemorrhages which rupture into the vitreous. A few cases are characterized by the proliferation of newly formed vessels in the retina and the

vitreous which are covered by a connective-tissue layer, different in appearance and genesis from the retinitis proliferans following partial absorption of a hemorrhage in the vitreous.

Hyaline and lipid deposits occur in any tissue that suffers from insufficient nutrition and oxygen supply. Such a condition must be present in the retina in the areas where the exudates are found. The small hemorrhages occur by diapedesis through the walls of the capillaries due to a condition of prestasis. That there is in the retina a chronic prestatic condition with a slowing of the circulation in the capillaries is also shown by the hyaline and lipid deposits, which indicate a disturbed nutrition of the retinal tissue. To explain the prestasis in the retinal precapillaries, with the resulting small hemorrhages, several factors require consideration: The hemorrhages occur in diabetics of all ages and have no relation to the changes in the retinal vessels and their consequences, which occasionally complicate the ophthalmoscopic picture. The hemorrhages occur with severe as well as mild diabetes and are at times discovered before it is known that glycosuria is present. To relate the capillary disturbance to the diabetes, one must consider the mild cases in patients with moderate hyperglycemia, with little secondary nutritional changes, and without the enormous carbohydrate depletion of the liver which results in secondary metabolic changes. Such individuals differ in no manner from nondiabetics save in the lessened ability to regulate the blood-sugar level. It is this prolonged, continuous, moderate-hyperglycemia which stands in some sort of causal relationship to the condition in the capillaries, with the resulting small hemorrhages. This explanation does not solve the whole question of the pathogenesis of diabetic retinopathy. It cannot be stated how the

hyperglycemia produces the retinal capillary peristasis, nor why the hemorrhages are not found in every case of diabetes. Although the large and massive hemorrhages that rupture into the vitreous can be assumed to be due to an aggravated form of prestasis, it is not known why this aggravated form occurs in only a limited number of cases of diabetic retinitis. The newly formed vessels that are found in some cases may possibly be explained by slowing of the circulation in a large number of capillaries at one time and in one area which supplies the stimulus for their formation.

There are no known means of preventing the occurrence of the retinal hemorrhages nor of causing their disappearance once they have occurred. Possibly control of the blood sugar at the normal level of 80-90 or even 100 mg. per cubic centimeter prevents the hemorrhages, but it is not possible to achieve this, and most physicians are quite satisfied when they can keep the blood sugar at about 130-150, which, however, is still a mild hyperglycemia and just the condition responsible for the capillary peristasis and the resulting retinal hemorrhages.

EYE COMPLICATIONS IN DIABETES FROM THE STANDPOINT OF THE INTERNIST

DR. ALBERT A. EPSTEIN said that the incidence of complications in diabetes mellitus is not related to the severity of the disease. Complications occur less frequently in juvenile diabetics than in older patients, although the disease is often more severe in the former. The ocular complications are among the most feared, and retinopathy and cataract give the greatest concern.

There are two views as to the cause of the complications. They may be, specifically, a result of the diabetes, or they may be secondary to antecedent degenerative vascular changes. If they are due to the diabetes directly, proper control of the

diabetes would be expected to prevent their occurrence. In the adequately treated juvenile diabetic, these complications should never develop. O'Brien and Allen found that these ocular changes cleared up with adequate control. Waite and Beetham found that the extension of the life of young diabetic patients permits the ultimate development of vascular sclerosis.

The evolution of the diabetic picture seems to be related to prenatal or hereditary influences; their occurrence in several members of the same family shows their genetic background. Proper control of the diabetes may limit their progression, whereas poor control may speed the maturation of the complications. There is a hereditary taint in every incident befalling the diabetic patient. The usual complications following the administration of insulin are, however, due to hydration; the sugar level of the blood falls rapidly, while that of the vitreous lags; the result is changes in osmotic pressure and in the refraction. The tendency to postoperative bleeding after the use of insulin preoperatively is due to alteration in the blood volume and calls for the judicious use of insulin prior to surgery. It may be that the elevation of the blood sugar is a physiologic adaptation to bring about its utilization; consequently, the lowering of the blood-sugar level by insulin requires care in its use.

The occurrence of local reactions at the region of injection of insulin—tumefaction and atrophy—suggests the possibility that similar toxic changes might take place in susceptible eyes despite their remoteness from the point of injection, as a result of long-continued use of the insulin.

SURGICAL EYE COMPLICATIONS IN DIABETES

DR. SIGMUND A. AGATSTON listed cataract, glaucoma, strabismus, and detach-

ment of the retina as the chief surgical conditions encountered in these patients.

The real gray diabetic cataract is seen only in younger patients. In patients past 60 years of age, the cataract differs in no way from the usual senile cataract and most commonly is nuclear, with some cortical opacities. Indications for surgery are the same as in the ordinary senile cataract. If visibility of the retina is fair or good and vision is disproportionately poor, pathologic change in the fundus or optic nerve, rather than the condition of the lens, is responsible for the loss, and operation is contraindicated. Loss of vision may be caused by iritis, retrobulbar neuritis, advanced diabetic retinitis, hemorrhage into the vitreous, thrombosis of the retinal vein, and detachment of the retina. These pathologic changes may be seen if the lens is transparent, but must be inferred mainly through light projection and visual field when ophthalmoscopy is impossible. The condition of the retina of the other eye is a more important guide than is the blood-sugar determination. Petechial or small retinal hemorrhages and retinal veins of normal character indicate a good surgical risk; whereas engorged veins and large hemorrhages indicate the opposite, and surgery should be delayed or avoided. Operation should be refused in the presence of hemorrhage in the vitreous, retinitis proliferans, or detachment of the retina.

The most frequent postoperative complications are recurrent hemorrhage into the anterior chamber, hemorrhage into the vitreous, detachment of the choroid, thrombosis of the retinal vein, secondary glaucoma, and expulsive hemorrhage.

Primary glaucoma—chronic, simple, or acute—occurs in diabetic subjects, with normal frequency. Surgery may be uncomplicated. Results are influenced by the condition of the retinal and uveal venous systems, as in cataract surgery. During an attack of acute glaucoma, the iris some-

times takes on the appearance of rubeosis, but unless the retinal veins are affected, the operative result is good, frequently even without excessive hemorrhage into the anterior chamber.

Cutting operations to relieve secondary glaucoma following thrombosis of the retinal vein are doomed to failure, necessitating ultimate enucleation. Cyclodialthermy has given relief without enucleation and, aided by a simultaneous paracentesis, has yielded fairly satisfactory results, even with return of light perception. For acute glaucoma occurring with rubeosis of the iris and hemorrhages into the vitreous, only paracentesis through the cornea should be attempted; even this may result in hemorrhage into the anterior chamber, and the prognosis is bad.

While successful intraocular surgery in the presence of a fairly healthy retina is possible with a blood-sugar level even as high as 300 mg. percent, it is best to reduce it by diet or insulin to 200 or less before operating, although it is better not to use insulin on the day of operation.

Squint in diabetic patients is based upon paralysis of the 3d, 4th, or 6th nerve. This generally results in spontaneous recovery after a few weeks to three months, and surgery is not required. Nuclear paralysis of individual muscles does occur, sometimes without recovery. These are probably vascular in origin, but neoplasm, syphilis, and encephalitis must be ruled out.

Ordinary retinal detachment does not occur in diabetics with increased frequency. Secondary detachments, which are frequently found in cases of advanced diabetic retinopathy with retinitis proliferans, are inoperable.

Discussion. Dr. Edward Tolstoi has also noted that eye changes are much more frequent in adults. He has not seen them in children, although he looks for them. In the younger diabetic, he has noted occasional pinpoint hemorrhages,

particularly if the patient is malnourished, and recalls that in the pre-insulin era this lesion was more frequent in children. Their disappearance or relative infrequency now may possibly be attributed to better nutrition rather than to mechanical factors as presented by Dr. Elwyn. There does not appear to be any definite relationship between hyperglycemia and the occurrence of these hemorrhages. A considerable group of diabetics in the second and third decades who had glycosuria and consequently hyperglycemia over a period of years, but who have been free of symptoms of diabetes and have been well nourished, did not reveal the hemorrhages that have been mentioned by Dr. Elwyn as the possible results of hyperglycemia *per se*. Dr. Tolstoi has the impression that so-called diabetic retinitis in the older-age groups represents a resultant of two factors: malnutrition and vascular disease; in the younger patient, malnutrition alone is responsible. When alloxan is injected into animals, the symptoms and signs produced are comparable to diabetes mellitus. Retinal hemorrhages occurred more frequently in those animals given a low-protein diet prior to the production of diabetes. This may be a clue to the nutritive factor.

The preoperative preparation of these patients must be individualized, and one cannot be dogmatic about saying which patients should have insulin.

It is true, as Dr. Epstein pointed out, that there are areas of atrophy where insulin is injected; there are also areas of atrophy near the site of injection. Dr. Epstein's hypothesis that the eye lesions may reflect insulin sensitivity is interesting but requires more supporting evidence.

Dr. A. A. Epstein stated that attempts to normalize the blood sugar in long-standing diabetes by means of insulin are frequently accompanied by untoward developments which occasionally may be

very serious. To support the view that the occurrence of diabetes in more than one member of a family is presumptive evidence of a regressive hereditary taint, even though direct heredity cannot be established, a patient with total diabetes of 27 years' duration was described. She was one of five sisters, four of whom had diabetes, although neither parent showed any sign of the disease. The patient showed no evidence of arteriosclerosis nor eye complications. Eye and vascular complications are not accidental nor the result of the diabetes, but are concomitant with and have the same genetic origin.

Dr. Isadore Givner stated that he had administered hesperidin to a series of 15 patients with diabetes, as a result of a statement by the late Dr. Gifford, at a meeting of the New York Diabetic Association, that vitamin P might be of value in the proliferating type of diabetic retinopathy. After one year, there was no improvement that could be definitely ascribed to this therapy. On the basis of Dam's work, in which he found that vitamin E lowers the blood-cholesterol level, these patients were given this vitamin, again with no definite improvement in the retinopathy.

Dr. Henry Dolger considers diabetic retinopathy to be not an ophthalmologic problem. The internist sees the lesion long before the visual disturbance warrants the attention of an ophthalmologist. There is no question as to the existence of a characteristic retinal picture specific for diabetes. It is seen most strikingly in young adults in whom hypertension and arterial changes do not confuse the findings. The characteristic retinopathy developed in 10 of a series of 43 children followed for over 10 years by Dr. Dolger and Dr. Fischer. During their first 10 years of observation they were optimistic, but, as the period was extended to 15 years and 20 percent of the patients developed varying degrees of inexorable

retinal damage, the optimism was no longer justified. The sequence of events often is: (1) an occasional, small, round hemorrhage is noted near the macula; and (2) with the passage of time, evidence of vascular involvement elsewhere becomes manifest; as, for example, mild progressive hypertension, increasing albuminuria, and X-ray evidence of arterial calcification in the extremities. The eye lesion is apparently the earliest manifestation of some diffuse vascular process; it is not an isolated finding, but is part of the peculiar vascular change in certain types of diabetes. The cholesterol is not significantly altered in these cases. The control of the diabetes and level of the blood sugar are equally irrelevant to the production of the lesion. It is an archaic concept to consider diabetes a simple disturbance of carbohydrate metabolism. Protein and fat metabolism are equally involved in the basic derangement.

Diabetic retinopathy is the most disturbing complication because it occurs in relatively young people and proceeds relentlessly to blindness despite any type of therapeutic approach. The overoptimism often expressed in the literature with regard to juvenile diabetes is dismaying. A report on 73 children having diabetes who were followed for 20 years was concluded with the optimistic claim that the juvenile diabetic can look forward to a normal life and relatively good health. Yet in this report it was almost casually and without anxiety mentioned that retinopathy was found in at least one quarter of the group. The 22 years since the discovery of insulin, and the excellent results of modern diabetic therapy with regard to prolonging life and improving nutrition and resistance, have not witnessed any significant reduction in the inevitable premature arteriosclerosis which continues to frustrate one's efforts.

Leon H. Ehrlich,
Secretary.

COLLEGE OF PHYSICIANS OF PHILADELPHIA

SECTION ON OPHTHALMOLOGY

March 15, 1945

DR. WARREN S. REESE, *chairman*

TRAUMATIC IRIDODIALYSIS: ITS SURGICAL CORRECTION

DR. A. BARLOW and DR. HERMAN L. WEINER (by invitation) stated that a direct blow on the eye will sometimes cause a detachment of the root of the iris from its ciliary insertion—traumatic iridodialysis. A small separation is of no concern from either a visual or a cosmetic viewpoint. Frequent instillations of atropine and protection from light by dark glasses or bandage may result in a reattachment, according to some authors. However, when the separation is large, there may be monocular diplopia due to a double pupil. Of graver concern in some cases is the unsightly cosmetic effect produced by the the distortion of the normal contour of the iris and pupil.

A six-year-old girl was struck in the left eye with a BB shot. She was admitted to the Mt. Sinai Hospital on April 28, 1943, soon after the accident. The eye was intensely injected, and the anterior chamber was filled with blood. The temporal base of the iris from the 1- to the 6-o'clock position was torn away from its ciliary attachment, which formed a large separation about 5 mm. wide in the horizontal meridian. The pupil was distorted and drawn nasally and up. The fundus could not be seen owing to the hemorrhage in the anterior chamber. The treatment consisted of atropine, antiseptic collyrium, and sterile dressings. As the hyphemia gradually cleared, a fairly good view of the fundus could be obtained through the pupil, but not through the dialysis. Apparently, the rupture had caused a separation of the iris stroma from its underlying pigment layer. The pigment layer

thus prevented a view of the fundus through the dialysis. Later the lens became opaque; a traumatic cataract was the result.

The following operation with its gratifying outcome was devised by P. C. Jameson, and is described by Wiener and Alvis in "Surgery of the eye." The technique, which was closely adhered to, was described as follows:

A small, curved-eye needle threaded with fine silk (6-0) was introduced in the sclera 2 or 3 mm. behind the limbus above the horizontal line, passed into the anterior chamber, under the base of torn iris, and out through the cornea. The needle was then removed. A similar suture was passed below the horizontal line. An incision was made in the limbus with a narrow keratome between the points of entrance of the two needles in the sclera. Through this opening a small, blunt iris hook was introduced; the hook engaged the thread between the iris and cornea, pulling the end of the thread out of the cornea, back into the anterior chamber, and through the wound out of the eye. The threads were then tied, so that the torn base of the iris was gently brought back to the sclerocorneal junction.

This operation was performed on October 10, 1943, about six months after the injury. Atropine was instilled, and the eye bandaged. The postoperative course was uneventful. The eye was redressed on the second day, and atropine instilled daily thereafter. The sutures were removed on the eighth day, and the child was discharged two days later. On January 13, 1944, the traumatic cataract was removed by a discission, and again by a capsulotomy on June 29, 1944. The result was a clear, fairly round pupil. An approximate correction with +12.00D. sph. gave 20/70 vision.

Comment. Reports in the literature on the surgical treatment of traumatic iridodialysis are not numerous. Most of the

operators have used the method of iris incarceration, either by pulling the base of the iris into the limbal incision, or by suturing with one or more sutures a few of the iris fibers to the scleral junction immediately behind the cornea. Ben Witt Key, in 1934, reported four eyes successfully operated on by the suture method; and Goldfeder, in 1932, reported two cases treated by the method of iris incarceration. Spaeth described a similar operation, also based on the principle of iris incarceration by sutures, which he prefers to perform under a conjunctival flap to prevent infection. Wheeler looks with disfavor on the method of iris incarceration which "drags the iris into the limbus wound in such a way as to form an iris prolapse." Neither does he approve of sutures, on the general ground that, "sutures should not be passed through eye structures unnecessarily." He maintains that "an attachment can be easily and permanently secured by simply carrying a tiny shred of tissue from the torn edge of the iris very slightly into the limbus wound." The Jameson operation does not incarcerate the iris between the lips of the wound, but brings the torn surface in contact with a freshened surface, within the anterior chamber. Reattachment takes place by agglutination through a plastic exudate thrown out from the iris at the point of contact.

Since they had had no previous experience with the surgical treatment of traumatic iridodialysis, they do not presume to judge the merits of this or other methods. In this particular case, they were fortunate in obtaining the desired result with the method described. When the patient was last seen, two weeks previously, about 18 months after the operation, there were no signs nor symptoms of any late complications, and the iris was still intact. The right eye remained normal throughout.

In conclusion they stated that they were

keenly conscious of the fact that this operation, like any other intraocular operation, was not without its potential risks, and should not be undertaken lightly. The operation should not be performed when the dialysis is small, or when the defect is concealed by the lids. But when the defect is large, and the cosmetic effect is such that it can be a source of real embarrassment, the operation is justified.

Dr. Barlow said that one of the possible dangers would be injuring the lens during the operation, thus producing a traumatic cataract. In this case, of course, the lens was already opaque, and this possibility was not faced. However, when the lens is clear, great care must be exercised not to injure it.

Another possible danger is infection. This, of course, is something which is feared in every intraocular operation. However, if the operation is done under aseptic conditions, and the culture is negative, the danger of infection should be no greater than in any other operation—cataract extraction for example—especially in view of the variety of sutures so popular in modern cataract surgery.

Another possible danger which should be mentioned is late secondary glaucoma. This is a possibility both after the traumatic iridodialysis and after the operation for its correction. However, as far as he knew, Dr. Barlow said that no such case of secondary glaucoma following the surgical correction of traumatic iridodialysis has ever been reported.

Discussion. Dr. Warren S. Reese said that before Dr. Barlow explained about the keratome incision, it occurred to him that it might be possible to avoid a keratome incision by using a self-threading needle, and two sutures, one of which would be passed between the two strands of the first just beyond its exit from the iris. The needles could be removed following the perforation of the cornea. The suture could then be pulled back into the

anterior chamber, one acting as a plug and preventing the other from slipping back through the iris.

Dr. James S. Shipman stated that in reading the technique of this operation, which is so well described and illustrated in "Surgery of the eye," he could not understand why the cornea would not be badly scarred in cases of iridodialysis sufficiently large to justify this operation.

In any iridodialysis that is large enough to justify this operation, it would be necessary to bring the needles out through the cornea fairly close to the center, and since these go all the way through the cornea, he does not see how permanent scarring with an accompanying reduction in vision can be prevented. Certainly, infection is also a danger, since the needles and sutures go out through the cornea, and the free suture has to be again pulled back into the anterior chamber. Extreme care should be taken to prevent contamination of this suture by the lashes, skin of the lids, and skin of the face. His experience with suturing the cornea has been that one is more likely to get some sloughing, with infection about the sutures, than when suturing is done through the sclera.

Regarding the conjunctival flap, he said he does not feel that this is necessary because it is likely to dam up the secretions and give rise to more sloughing about the sutures. He stated that this operation is a very ingenious one, and one which on several occasions he had been tempted to try but had refrained for fear of the damage which it might do to the cornea. It has been pointed out by Dr. Wiener that small iridodialyses do not cause sufficient trouble to warrant the dangers of this operation, and the very extensive ones certainly bring up the question of corneal scarring. He asked Dr. Weiner to relate just what the final amount of scarring in the cornea was.

Dr. Herman L. Weiner, in closing, an-

swered that they were quite aware of the fact that the cornea must have scars following an operation of this type. A rather fine round needle was used with no. 6-0 silk. The resulting scars were pin-point and could be seen only under bright illumination and slitlamp examination. Vision was not impaired by the scars.

RE-EVALUATION OF THE HERBERT FLAP OPERATION FOR GLAUCOMA

DR. LOUIS LEHRFELD stated that Lt. Col. H. Herbert of the Indian Medical Service contributed many splendid articles on the surgical treatment of glaucoma from 1903 to 1934.

Of the many types of operations suggested by Herbert, the flap operation, sometimes known as the trapdoor operation, is revised by the author for cases of absolute glaucoma. Seven cases were reported, two of which were especially related in detail because of the splendid results in reducing the intraocular pressure.

Herbert's original operation is described as an anterior sclerotomy in which the horizontal incision is made in the sclera at varying distances from 1.5 to 3 mm. above the limbus. Two vertical incisions are made, one at each end of the horizontal incision toward the cornea; the effect is of an inverted U-shaped trapdoor covered by the overlying conjunctiva.

The modification suggested by the author is in the location of the trapdoor—namely, in the position of the pars plana of the ciliary body, which he describes as the silent area of the eyeball. The location has the advantage that it is sufficiently distant from the lens and from the corneoscleral junction, where surgery in itself leads to many complications and unsuccessful results.

He recommended a modified Herbert trapdoor operation for the acute and

chronic forms of glaucoma. The following reasons were offered: (1) the simplicity of the technique; (2) the lack of complications; (3) its effectiveness in reducing the intraocular pressure gradually; and (4) because it is located in the vitreous segment of the globe, remote from the canal of Schlemm, the iris, the lens, the root of the iris, and corneoscleral junction which in most instances have already been damaged by increased intraocular pressure.

A number of lantern slides were exhibited illustrating the Herbert operation, and the new point of approach suggested by Dr. Lehrfeld.

SYMMETRICAL DEFECTS IN THE LOWER LIDS ASSOCIATED WITH ABNORMALITIES OF THE ZYGOMATIC PROCESSES OF THE TEMPORAL BONE

DR. IRVING H. LEOPOLD, DR. FRANCIS MAHONEY (by invitation), and MABEL LEE PRICE, M.S. (by invitation) stated that symmetrical defects in the lower lids associated with bilateral absence of the zygomatic processes were reported in a child, in the child's mother, and in the mother's father. A pedigree was traced for this family which suggested the hereditary nature of these defects, and that the responsible gene is a dominant one. X-ray studies established the fact that the deficiency of the zygomatic process is associated with the lower-lid deformity and, in addition, demonstrate that the osseous deficiency is similarly transmitted. The presence of normal facial bones other than the zygomatic process of the temporal bones, and normal clavicles would exclude these cases from the cleidocranial-dysostosis group.

Although the lid defects in the three cases presented are very similar to those observed by others, the bony defects are chiefly of the zygomatic processes of the temporal bones, and not of the zygoma

bones, as has been described in the earlier reports of others. None of the previous reports noted an associated osseous deficiency in other members of the respective families.

Dr. Francis Mahoney mentioned that there are numerous types and groups of dysostoses of the cranial bones. The commonest are the meningocele and encephalocele, and less common are those cases with a congenital absence of the superior orbital wall. In these cases there is a characteristic pulsation of the globe synchronous with cardiac pulsations. The least common is the "Lückenschädel" or lace-work skull. This is the most severe and extensive of the dysostoses of the skull. None of these are hereditary in nature.

There have been three types reported with a hereditary link. This group of cases is a fourth type in this series.

The most spectacular of these, of course, is hereditary cleidocranial dysostosis, where there are associated cranial defects in individuals with deficient or absent clavicles. Some of these people can bend forward, and touch their two shoulders together. They have, as Dr. Leopold described, changes in the facial bones, but these changes are in the maxillae, with deficiencies in the maxillary teeth and malocclusion with the mandibular teeth.

Another type is hereditary craniofacial dysostosis. This appears to be a group in which the skull and facial-bone changes are very similar to those presented in cleidocranial dysostosis but the changes in the clavicles are absent.

The third group, which seems closest related to this group, comprises the hereditary ectodermal dysplasias. In these cases there is a deficiency in the sweat glands and scanty or missing hair. Usually the upper incisor teeth are missing. The skull has a hydrocephalic appear-

ance with a "too large head upon a too small face."

In this group of cases the cranial bones were well formed. There was no disproportion between the bones of the vault and the bones of the face. There was no deficiency or malocclusion of the teeth. The clavicles were normal. The only bony deficiency was the absence of the zygomatic processes of the temporal bones. However, the changes in the lower eyelashes, and in the glands around them would point to some link with the hereditary ectodermal dysplasias.

INTRAVITREAL PENETRATION OF PENICILLIN AND PENICILLIN THERAPY OF INFECTIONS OF THE VITREOUS

DR. IRVING H. LEOPOLD stated that experimental studies with rabbits revealed that intramuscularly and intravenously administered penicillin in a concentration of 4,000 units per kilogram failed to produce detectable concentrations of penicillin.

Prolonging the length of time that penicillin remained in the blood stream by employing a penicillin-gelatin-vasoconstrictor preparation failed to increase the intravitreal penetration of penicillin from the blood stream in the normal rabbit eye.

Subconjunctival injection of penicillin and injection of the substance into the anterior chamber produced detectable concentrations of penicillin in the vitreous in the normal rabbit eye.

All methods of administration produced higher concentrations of penicillin in the vitreous humor in the rabbit eyes with infection of the anterior chamber than in normal eyes.

Theoretically adequate concentrations of penicillin in the vitreous were obtained with administration of penicillin by subconjunctival injection and by injection into the anterior chamber in the inflamed

rabbit eye. Such levels were adequately maintained for three hours after one injection.

Higher concentrations of penicillin in the vitreous were obtained in eyes with iridectomies than in normal eyes after injections of penicillin into the anterior chamber.

Penicillin intravenously administered failed to stop the progression of experimentally induced ectogenous infections of a vitreous caused by a penicillin-sensitive strain of *Staphylococcus aureus*.

Repeated conjunctival injections of penicillin and injections into the anterior chamber halted the progress of intravitreal infection due to *Staphylococcus aureus* in 4 of 10 rabbit eyes.

Intravitreal injections halted the progress of ectogenous infections of the vitreous due to *Staphylococcus aureus* in all eyes receiving one injection consisting of more than 500 Oxford units of penicillin. Lower concentrations than this, including five units per injection, were partially successful.

Discussion. Dr. W. Zentmayer said that Rycroft quite recently reported the results obtained with penicillin by the ophthalmologists in British North Africa and Central Mediterranean Forces. The study is largely clinical, and this may explain the apparent disagreement between their results and those given here by Dr. Leopold. From their findings penicillin does not enter the ocular media when given by intramuscular injection. Such injections do not influence the course of deep infections of the eye. The eye will tolerate large concentrations of penicillin injected into the media, but such concentrations do not control deep infections.

Dr. H. Maxwell Langdon said that the organism with which these experiments were done was selected especially for its nonresistant powers to penicillin. It would be interesting to know the effect on other organisms in the vitreous. Those

resistant to penicillin, of course, have been fairly well recognized and classified, but, as he understands it, some are more readily affected than others. Without cultures, of course, these could not be identified; so it is bound to be more of a trial-and-error procedure in the ordinary clinical case. It is a valuable piece of work, and possibly may result in the saving of eyes which otherwise might be given up as hopeless.

Dr. Irving Leopold, in closing, said that he, too, had found Colonel Rycroft's article very discouraging. All of Rycroft's cases of vitreous inflammation were due to intravitreal foreign-body penetration. Only two of these cases showed improvement, and these two were ones in which the offending foreign bodies were removed. In not one did aqueous or vitreous cultures reveal that the exciting, inflammatory agent was a penicillin-sensitive organism.

In all of Rycroft's cases intravitreal penicillin injections were not made until the inflammatory process had become well established. In the experiments on rabbit eyes, therapy was instituted two hours after vitreous inoculation with *Staphylococcus aureus*. Von Sallmann's studies indicate that little can be expected from direct intravitreal injection of penicillin later than 12 hours after inoculation of the penicillin-sensitive organism, but that excellent results may be obtained by earlier institution of therapy.

Rycroft's studies on human eyes showed, as did the experimentation on rabbit eyes, that intramuscularly administered penicillin did not produce detectable levels in the vitreous of normal eyes. He could not detect penicillin in the vitreous of inflamed human eyes after intramuscular administration; whereas, the vitreous of inflamed rabbit eyes did possess detectable but inadequate concentrations of penicillin.

It is known that the permeability of

rabbit ocular capillaries is greater than that of human capillaries in inflammatory states. For example, Brown and Nantz pointed out that the rabbit's secondary aqueous contains considerable fibrin; whereas, the adult human eye shows very little if any fibrin in its secondary aqueous. This permeability difference must be kept in mind in drawing analogies between the data accumulated by experimental studies on rabbit eyes, and that of human cases.

The *Staphylococcus aureus* organism was used in these studies because it is extremely sensitive to penicillin. The main purpose of the experiment was to compare the possible chances of controlling the vitreous infections by the various methods of administration. He said he believed that the experimental data have shown that systemic therapy is not adequate. Rycroft's experience would bear this out. The experimental studies indicate that direct intravitreal injections may be effective if one treats the infection early enough. This latter observation can be said to apply only when the vitreous infection is due to a penicillin-sensitive organism.

Dr. Leopold said he agreed with Dr. Langdon that these experiments are only an introduction to the problem of treating vitreous infections, and much more work will have to be done both in the laboratory and clinically before the ideal method of treating vitreous infections with penicillin will be known.

George F. J. Kelly,
Clerk.

BROOKLYN OPHTHALMOLOGICAL SOCIETY

October 18, 1945

PENICILLIN IN OPHTHALMOLOGY (PRACTICAL VIEWPOINTS)

DR. LUDWIG VON SALLMANN limited his report to practical suggestions as to the

use of penicillin in ophthalmology and distinguished between various types of administration depending upon the site of the infection. Surface infections of the lid border, conjunctiva, and cornea benefit from the use of penicillin in aqueous solutions, ointments, and gelatin discs when the strain of the microorganism is relatively susceptible. Data were presented on dosage, frequency of application, and the advantages of certain ointment bases and penicillin salts. For acute ectogenous infections of the anterior segment of the eye, iontophoresis and the placing of cotton packs in the conjunctival sac secure adequate concentrations of penicillin in the eye, whereas subconjunctival injection does not. Another method of treating infections of the anterior segment would be by replacing the aqueous with a penicillin solution containing 1,000 to 2,000 Oxford units. Gratifying results were observed when the infection had not spread to deeper parts of the lens or to the vitreous space.

Infections of the lens and vitreous can be attacked by direct injection of penicillin in a concentration that does not cause damage. Encouraging clinical results are at hand in cases in which the infection was not older than 48 hours. In more advanced infections the inflammation may subside but the function will not be restored. Systemic therapy can be used as an adjuvant in ectogenous infections but is of significant value in metastatic infections.

DISEASES OF THE MACULA

DR. RALPH I. LLOYD surveyed this subject, demonstrating with kodachrome slides the condition of the fundus in his comprehensive talk. He emphasized especially the differentiation between hereditary and acquired disease of the macula and discussed at some length the subject of eclipse blindness.

George A. Graham,
Associate secretary-treasurer.

OPHTHALMOLOGICAL SOCIETY OF MADRID

December 21, 1945

DR. MARÍN AMAT, *president*
SCIENTIFIC SESSION

CHOLINE IN SERPIGINOUS ULCERS OF THE CORNEA

DR. ENRIQUE MARÍN ENCISO used choline in his clinics at the Provincial Hospital of Ciudad-Real, based on the article of Drs. T. J. Dimitry and P. Aznar, entitled "The use of choline in cases of ulcer and leukoma of the cornea" published in the American Journal of Ophthalmology, for January, 1945, and gave an account of its favorable results in his doctor's thesis, which was read last October.

Dr. Marín Enciso confirms all findings in his doctor's thesis, and adds eight clinical histories of patients with serpiginous ulcer of the cornea, in which a 1-percent solution of choline, injected several times a day, produced a rapid cure with a minimum of scar tissue.

He called attention to the use of choline with mercurochrome which acts well in combination. He has used a 1-percent solution of choline with good results in subconjunctival injections as well as in the conjunctival sac. Dr. Marín Enciso stated that it was unnecessary to remove the tear sac in any of his patients or perform other types of dacryocysto-rhinostomy. Had these operations been performed, success would have been still greater in that the condition would have improved more quickly.

CHOLINE IN OPHTHALMOLOGY

Dr. Marín Amat, impressed by the work of Drs. Dimitry and Aznar, had also used choline in a 1-percent solution in many cases of serpiginous ulcer of the cornea, and obtained wonderful results.

Dr. Marín Amat used choline and mercurochrome in combination, having noted that choline, which has a tremendous penetrating power on the tissues, so enhances the action of mercurochrome that the bactericidal effect is increased. He also used choline in cases of incipient panophthalmitis, in purulent iritis, in infection of the filtering tissues following Elliot corneoscleral trephining, and in the post-traumatic suppurations of the eyeball.

Dr. Marín Amat has also used a solution of choline in cases of leukoma of the cornea caused by lymphatic ulcers, for corneal bullae, and for serpiginous ulcers of the cornea, and he reported four clinical histories showing good results.

Dr. Marín Amat has had no experience with choline in old cases of leukoma because of the brief period of use. However, judging from the statements of the American doctors, and by what he has verified in recent cases, he believes it to be of great help. He has likewise used choline in the infiltration of cholesterol in the cornea, having had better results than he had obtained with all other general as well as local treatments.

He was equally impressed by an article by Drs. Dimitry and Lombardo, "The lipotropic effect of choline in retinal tuberculosis," which was published in the American Journal of Ophthalmology for August, 1945. This article referred to a case of hemorrhages and tubercles in the retina, which in the space of two weeks, under the administration of 25 centigrams of choline, three times daily, disappeared completely. Dr. Marín Amat used choline in two cases of relapsing hemorrhages of the vitreous. Improvement resulted in one case, but the result in the other case was not known, as the patient did not return.

Since chlorhydrated choline is extremely deliquescent, it must be used in a water-diluted solution of proper dosages. The

best treatment is 20 drops (taken 15 minutes before each meal) of chlorhydrated choline—5 grams in 20 grams of distilled or redistilled water. Dr. Marín Amat has used 1 c.c. of choline repeatedly, subconjunctivally, in a solution of 1:300, with satisfactory results. The injection is entirely painless.

CAN GLAUCOMA BE AN OCCASIONAL CAUSE OF DEATH?

PROF. B. CARRERAS DURAN reported two cases in which glaucoma caused death. The first, an acute case of glaucoma, accompanied by vomiting, occurred in the consultation room of the physician. The patient, through the strain of vomiting, had died of an apoplectic attack. In

the second case, of a patient with staphyloma, a hemorrhage occurred which persisted in spite of all medical and surgical means employed to stop it, causing the patient's death.

BILATERAL LUXATED LENSES

DR. BARTOLOZZI presented a woman who belonged to the service of Professor Carreras of the Madrid Faculty of Medicine. Both crystalline lenses were luxated into the posterior chamber coincident with lesions of the base of the eye of the hereditætic type. The etiology had not been established. It was still being studied.

Apropos of this case, Drs. Marín Amat and García Miranda told of analogous observations made by them.

AMERICAN JOURNAL OF OPHTHALMOLOGY

Published Monthly by the Ophthalmic Publishing Company

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DR. W. H. CRISP AN APPRECIATION

Dr. William H. Crisp's editorial in the January issue, announcing his retirement as editor of the abstract department, should not go unnoticed. Only those of us who have been in close association with Dr. Crisp in Denver and those actively engaged in the publishing of the Journal have any conception of the effort that he has expended. But anyone may look through the ophthalmic literature and note the hundreds of original papers, brilliant editorials, and abstracts that he has written and the thousands of abstracts and original papers that he has edited.

The abstract department under Dr. Crisp's guidance has not only given the reader a rapid survey of the important ophthalmic literature, but has lightened the task of searching through the literature for knowledge on a particular subject. Only the combination of a brilliant mind, a desire for perfection, and a disregard for financial considerations could permit such a public-spirited accomplishment. Dr. Crisp's ability to read many languages has been a vital aid in the accuracy and completeness of the abstract department.

Dr. Crisp speaks of the "evening of life," but those of us closely associated

with him notice no evening of mental vigor and enthusiasm. We wish him many years of successful practice and are happy that he now has more time to direct his activities to the artistic endeavors in which he has perfected himself. We, of the Colorado Ophthalmological Society, wish publicly to express gratitude to a colleague "who worked that we might know and that patients might profit."

Members of the Colorado
Ophthalmological Society

A NATIONAL PROGRAM FOR TRAINING IN OPHTHALMOLOGY

Quite admirably, the emphasis of this Journal's editorial comments in recent months has been upon postwar training in ophthalmology. There is common agreement as to the urgency of the problem, but the conclusions as to how much may be accomplished are scarcely optimistic.

World War II has intensified a problem which existed before the war. In this, as in other fields, it has accumulated demand and diminished supply. The country as a whole has never had an adequate and unified program of training in ophthalmology. Perhaps the war will make it possible for us to accomplish something which we have not achieved before.

A worthy effort is that of Harvard University to provide, for a maximum of thirty postgraduate students, a two-months course in fundamentals (much of which Lancaster reminds us can be taught by lectures, reading, and quizzes) followed by a clinical course of one month. These short programs should be stimulating to young ophthalmologists whose time was badly wasted during the war and who are eagerly looking for refresher courses. By themselves, the two Harvard courses cannot, it is obvious, create first-class ophthalmologists.

Vail reminds us that of fifty-nine class-A medical schools not more than six are giving or are planning to give basic courses in ophthalmology. Some schools are offering courses of six or nine months. Lancaster frankly quotes the American Board of Ophthalmology as consistently urging that "short courses are an abomination—unsound pedagogically and productive of a poor grade of practitioner."

Yet short courses, rightly planned, can teach a great deal. The student who gets least out of a short course is he who has done little or no systematic reading before beginning the course. The student who has read systematically, deliberately, and intelligently may absorb much in a short time, and it is doubtful whether any student should be allowed to follow a clinic without being able to show that he has previously pursued such a thorough course of reading. This is especially true with regard to refraction, which is the economic basis of a beginning practice in ophthalmology, but which is perhaps less systematically approached by the average student than any other part of the subject.

More than ever before, governments are now disposed to cooperate in the provision of education for various professions. It is obvious that the most successful utilization of this governmental tendency is likely to occur under adequate guidance and pressure from within the group of educators in ophthalmology. In spite of the general dislike for governmental interference in the field of medicine, it is probable that any relatively adequate scheme will have to depend in large measure upon government financing. It is worth the nation's while to contribute to institutional and individual financial need in pushing the educational program in ophthalmology.

So far as clinical facilities are concerned, we may have to meet the emergency by accepting less of thoroughness

than we might have demanded before the war, or than we shall demand when the emergency is past. Many intending ophthalmologists will continue to pick up their knowledge rather casually, through assistantships or through courses by commercial clinics.

Perhaps we are attempting for a few an excess of thoroughness as compared with the magnitude of the problem as a whole. Mann makes the interesting remark that "on one side of the Atlantic the aim is the very thorough and complete training of a relatively few high-grade specialists, while on the other side we aim at basic instruction of a larger number for a shorter time, leaving it to the initiative of the few to obtain for themselves the final gloss and polish of academic distinction requisite for the highest grade."

In the presence of a really national problem, it seems essential to formulate a national program, partly through conference between educators and partly through coördination between educators on the one hand and departments of the national government on the other. Such a program might well represent compromise between conflicting views as to the scope of education in ophthalmology, so that an approximately uniform curriculum might be applied to different sections of the country. Or certain parts of the program might be presented in some educational centers, to be supplemented by other parts of the program in other centers. A program that is national and coördinated, rather than local and spotty, appears called for by the necessities of the situation.

A need not altogether easy to supply is that of an adequate staff of teachers. For one thing, most medical educators who are also private practitioners can do a much more thorough job away from home than in their own communities, because it is hard to escape the importunities of patients in the home area. Yet it should be

possible to create, all over the country, a staff of teachers who could afford to leave home practice for national service in ophthalmic education, perhaps several times each year. The greatest sphere of usefulness of the veteran teacher and clinician lies in handing on to another generation the results of his own study and experience.

It is to be hoped that effect may be given to Vail's frank and practical suggestion that combined residencies in ophthalmology and otolaryngology be divided into two parts, one devoted to each specialty, for experience has shown that, at least as regards ophthalmology, the educational result suffers from the combination.

W. H. Crisp.

TRIDIONE AND THE EYE

There has recently appeared in the field of therapeutics a new synthetic compound, Tridione (3, 5, 5-Trimethyloxazolidine-2, 4-dione, Abbott). This drug is being used as an anticonvulsant in the treatment of epilepsy, particularly for its inhibiting effect on *petit mal*, and on myoclonic and akinetic seizures in epilepsy, and is being prescribed for other forms of psychomotor attacks, such as the spasmodic tremors and tics of parkinsonism. The results are promising.

One of the unpleasant and disturbing side effects of Tridione therapy is the so-called "glare phenomenon" complained of by patients taking the drug in from moderate to large doses. This phenomenon is described by patients in various ways, from inability to see black on white, or colors against a light background, to complete day blindness. The symptoms disappear when the drug is stopped, but there is a time lag, probably depending on the duration of the use of the drug, which would indicate that there was some

accumulative effect. For example, one patient recently studied did not recover from the "glare phenomenon" for two weeks after the drug was discontinued.

The ophthalmic examination of these patients is an interesting experience. The phenomenon is a puzzling one that requires further investigation. Vision is normal when tested with an unlighted chart but decreases to an average of 20/100 when the chart is illuminated. On putting on dark glasses, the patient can read the letters on the chart easily, as a rule. The fields of vision, both peripheral and central, have been found to be unaffected, and the ophthalmoscopic examination reveals no detectable disorder in the ocular fundus. The color vision when tested with the Ishihara test is likewise undisturbed.

Curiously enough, the reading vision is not particularly affected, at least in the few patients recently studied, although each patient preferred to read through tinted lenses.

The group studied were willing to put up with the "glare phenomenon" because they felt better under this treatment than otherwise, and were not too uncomfortable when they wore their dark glasses and avoided bright sunlight.

It is interesting to speculate just what goes on in the eyes to produce this symptom. There is apparently no damage to the visual system—at least none that can be demonstrated. Caution is needed, however; whether or not serious harm can arise from the administration of the drug has not yet been determined. The use of large doses of vitamin A has had no influence on the symptom, nor has any other treatment, so far as is known, had any effect. Histologic studies on the optic nerves and retinas of experimental animals receiving large doses of Tridione over long periods of time have failed to reveal any evidence of damage. But it

would be wise to limit the use of the drug to those patients who show no optic-nerve disease, or who are not taking concurrently a drug that may injure the optic nerve.

This editorial is written for the purpose of drawing the attention of the ophthalmologist to this new therapeutic agent that may not be entirely innocuous to sight, and as a plea for further studies, both chemical and experimental, to determine, first, how the "glare phenomenon" is induced; secondly, what, if anything, can be done to counteract it; and, finally, if thereby any residual permanent damage is produced in the visual system. This last is most important. It would be wise, therefore, for each ophthalmologist to acquaint himself with Tridione and to be alert to discover the answers to these important questions.

Derrick Vail.

CORRESPONDENCE

DISPENSING WITH BIFOCALS

Editor,

American Journal of Ophthalmology:

The communication of Dr. L. J. Alger in the February issue of the American Journal of Ophthalmology is a timely reminder of what may sometimes be done to avoid bifocals, especially for those who find the adjustment to bifocals inordinately difficult. The method is also applicable for presbyoptic patients other than those having alternating strabismus. Although not frequently described, this method has been used occasionally by many doctors. It is really a procedure akin to that sometimes used by anisometropic patients who all their lives have relied on one eye for sharp vision at distance and the other eye for sharp vision at near.

The first such case was brought forc-

ibly to my attention some 30 odd years ago when a doctor described a patient who came to his office. An elderly gentleman brought a little granddaughter for an eye examination as directed by the school nurse. The doctor took the patient's vision and found it markedly subnormal. A flash with the retinoscope showed the child to be myopic, and the doctor told the grandfather who had accompanied the child to the examination room, that she would have to wear glasses. The old gentleman was rather put out by this information and remarked that something must be wrong with the new generation because he could read the smallest letters on the chart without any glasses, as, in fact, he could. The doctor then confidently remarked that to offset this, the little girl could read at near without glasses which the old gentleman could not do. Whereupon the old gentleman said the doctor was all wrong, for he could read the finest print at near without glasses.

A check up by the doctor on the old gentleman's eyes disclosed what the reader may have already surmised; namely, that the man had one eye practically emmetropic and the other eye about 2.50D. myopic. Without knowing it, and without loss of binocular fixation, the old gentleman was using the emmetropic eye for keen distance vision and the myopic eye for keen near vision. There was no strabismus, both eyes were fixating, but one eye took the lead for distance vision, and the other took the lead for near vision.

Such a condition, in which both eyes fixate, and only one eye focuses, does not seem to disturb vision as much as one would expect. I can speak from personal experience because my own eyes are anisometropic in a similar way. When fixating with both eyes, the nonfocusing eye does impair the vision of the focusing eye to some extent, but many a patient would rather bear this than wear bifocals. For in anisometropia especially, bifocals bring in disturbances to which the patient finds it harder to adjust himself.

Of the several difficulties encountered by bifocal wearers, I think the limitation of the field for both far and near looms large—sometimes subconsciously. Even single-vision lenses, set in a frame or mounting, restrict one's visual field. Anyone who has worn glasses, unless he is extremely myopic or astigmatic, frequently gets a feeling of relief when he removes his glasses. This is largely due to the removal of an obstruction to his visual field.

This field limitation is of course much more marked when bifocals are worn. The use of single-vision lenses set to have one eye focused for distance and the other eye for near gives the patient full binocular-field vision for far and near, with sharp monocular detail vision at both distances. It is a procedure that deserves the ophthalmologist's serious consideration.

(Signed) Joseph I. Pascal,
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ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the *Ophthalmic Year Book*. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the *Journal*.

CLASSIFICATION

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| 1. General methods of diagnosis | 10. Retina and vitreous |
| 2. Therapeutics and operations | 11. Optic nerve and toxic amblyopias |
| 3. Physiologic optics, refraction, and color vision | 12. Visual tracts and centers |
| 4. Ocular movements | 13. Eyeball and orbit |
| 5. Conjunctiva | 14. Eyelids and lacrimal apparatus |
| 6. Cornea and sclera | 15. Tumors |
| 7. Uveal tract, sympathetic disease, and aqueous humor | 16. Injuries |
| 8. Glaucoma and ocular tension | 17. Systemic diseases and parasites |
| 9. Crystalline lens | 18. Hygiene, sociology, education, and history |
| | 19. Anatomy, embryology, and comparative ophthalmology |

3

PHYSIOLOGIC OPTICS, REFRACTION, AND COLOR VISION

Hardy, L. H. Standard illuminants in relation to color-testing procedures. *Arch. of Ophth.*, 1945, v. 34, Oct., pp. 278-282.

Tests for defective color vision always involve three factors: the light with which to see, the subject tested, and the materials and procedures of the test. Failure to standardize two of the three factors causes invalid results in evaluating the third factor. Most tests for color vision are carried out under such nonstandard conditions that they test the illumination as much as they test the ability of the subject to distinguish colors.

The author points out the extreme variability in the color value of various illuminants, especially of daylight. Standards set up by the International Commission of Illumination are discussed. I. C. I. illuminant C is the choice for all work in testing color vision which involves the use of reflected light and, unless special conditions are

indicated, should always be utilized. A close approximation to this illuminant is commercially available at relatively low cost.

John C. Long.

Hardy, L. H., Rand, G., and Rittler, M. C. Tests for detection and analysis of color blindness. 1. An evaluation of the Ishihara test. *Arch. of Ophth.*, 1945, v. 34, Oct., pp. 295-302.

The color perception of subjects was tested with a battery of different tests designed to detect and classify color blindness. All of the examinations using pigment test material were carried out under a close approximation to I. C. I. illuminant C. The following conclusions concerning the fifth edition of the Ishihara test seem justified: The test affords a good rough device for screening persons with defective red-green vision from persons with normal color vision if a performance score of 60 is taken. No analysis as to type or extent of defect can be based on performance scores. The test yields a lower score for the deuteranopic than for the protanopic type of defective

color vision. It fails to classify the type of defective color vision and cannot be used to give a satisfactory evaluation of either the extent or the degree of the defect. Plate 4 is a practically perfect screening test when properly used.

John C. Long.

Kayser, B. A chronic gastrointestinal ailment caused by a derangement of ocular functions. *Klin. M. f. Augenh.*, 1942, v. 108, Sept.-Oct., p. 626.

In a woman 36 years of age, a chronic gastrointestinal ailment had resisted all other forms of therapy, among which were extirpation of the appendix and gallbladder, over a period of 14 years. She was immediately relieved of all symptoms when she was given spectacles which corrected a refractive error and an imbalance of binocular coördination.

F. Nelson.

Martin, H. G. Continuation of the screen test. *Amer. Jour. Ophth.*, 1946, v. 29, Feb., pp. 196-200.

Ogle, K., and Ellerbrock, V. J. Stereoscopic sensitivity in the space eikonometer. *Arch. of Ophth.*, 1945, v. 34, Oct., pp. 303-310.

The space eikonometer has recently been shown to be a suitable instrument for the measurement of aniseikonic errors. This instrument differs from the standard eikonometer in that the measurement depends on binocular perception rather than on a direct comparison of image size. The space eikonometer is so constructed that the apparent orientation of test objects can be perceived only by binocular space perception. If an aniseikonic error exists between the two eyes, these test objects will appear incorrectly oriented to the subject. By means of suitable size lenses the relative size of the

images in the two eyes can be changed until the test objects appear correctly oriented. The magnifications introduced to achieve this objective measure the aniseikonic error.

The construction of the instrument is briefly described. Data obtained on subjects are presented and analyzed. The authors conclude that the results of this study of sensitivities emphasize the accuracy of the space eikonometer for the detection and measurement of aniseikonic errors. John C. Long.

Simonson, E., Blankstein, S. S., and Carey, E. J. Light and dark adaptation. *Amer. Jour. Ophth.*, 1946, v. 29, March, pp. 328-340. (8 tables, references.)

Slataper, F. J. Accommodation of presbyopia and its correction. *Arch. of Ophth.*, 1945, v. 34, Nov.-Dec., pp. 389-397.

The correct addition for near vision in presbyopia depends primarily on the amount of available accommodation and secondarily on the selection of the best fixed distance for near work.

In reporting a tremendous amount of research work on the subject the author's conclusions are that:

1. The correct estimation of the patient's total accommodation is the most important factor in the correction of presbyopia with a glass for near work.
2. It is necessary to use three types of tests to measure accurately the total accommodation in many patients: (a) The near blur test—after Duane; (b) The "reads best" test—the most common method; (c) The + and -1.00D. spheres average-readability test; (d) The + and -0.50D. spheres coöperation test will show the cause in case of failure.
3. The normal reserve accommodation for all near work is exactly 1.00D.

4. The available accommodation for near work is the total accommodation less 1.00D.

5. The best fixed distance for close work depends on the following factors: (a) visual acuity, (b) nature of occupation, (c) muscle balance, (d) length of arms, (e) monocular or binocular vision, and (f) long-established reading habits.

R. W. Danielson.

Sloan, L. L. Atypical achromatopsia. *Amer. Jour. Ophth.*, 1946, v. 29, March, pp. 290-294. (3 tables, 3 figures, references.)

Sloane, A. E. and Gallagher, J. R. Evaluation of stereopsis. *Arch. of Ophth.*, 1945, v. 34, Nov.-Dec., pp. 357-359.

Increasing use of visual tests in the field of personnel selection, special military needs, and the rapid expansion of aviation have stimulated interest in techniques which measure stereopsis.

The entire student population of a boys' preparatory school was given a thorough ophthalmic examination, and from this group of 720 boys 186 who fulfilled the following requirements were selected for the tests of stereoscopic ability: normal color vision, a normal external ocular condition, normal fundi, normal pupils, a visual acuity of 20/20 in each eye, less than 1.5D. of hyperopia, less than 1.25 prism diopters of hyperphoria, less than 4 prism diopters of exophoria and less than 6 prism diopters of esophoria at 20 feet (6 meters); less than 6 prism diopters of esophoria and less than 8 prism diopters of exophoria at 16 inches (40 cm.), and less than 1.00D of astigmatism. Hyperphoria was measured with the Maddox rod; exophoria and esophoria at 20 feet with the Maddox rod and the cover test, and at 16 inches

by von Graefe's prism test and the cover test.

The distributions of the averages of three responses to each of these tests are given, and the higher coefficients of self-reliability between trials on the Verhoeff test are offered as evidence of the superior efficiency of this test. The Verhoeff test is the more sensitive in detecting persons with poor stereopsis. The essayists believe that the Verhoeff test yields a superior estimate of acuity of binocular stereopsis. However, the value of the Howard-Dolman technique in the appraisal of aptitude for activities which require a number of attributes, should be kept in mind.

R. W. Danielson.

4

OCULAR MOVEMENTS

Lijó Pavia, J. Heterophoria and the orthofusor. *Rev. Oto-Neuro-Oft.*, 1945, v. 20, Sept.-Oct., pp. 106-111.

Horizontal heterophoria not exceeding 14 degrees should be treated with the orthofusor. This instrument employs stereoscopic photographs, polarizing light, and polaroid lenses. As in a major amblyoscope, each eye can be made to see a separate picture, and by use of prisms the apparent deviation of the eyes can be measured and the phoria treated. Pictures varying in complexity are employed to train and develop binocular single vision. (1 drawing.)

Edward Saskin.

Walker, J. P. S. Operation for correction of paralytic external (lateral) rectus palsy. *Brit. Jour. Ophth.*, 1945, v. 29, Sept., pp. 477-479.

Two cases are reported in which a modified Lancaster operation for the correction of palsy of the external rectus was done. The internal rectus

was recessed and stitched to the sclera, slightly anterior to the equator. The performance of this recession differs from that of the Lancaster operation. The external rectus was then resected and advanced after the outer third of the superior and the inferior rectus had been stitched to the stump of the insertion of the external rectus.

The outcome of both operations was entirely satisfactory. Synoptophore readings, taken before and after operation, may serve as a guide in other cases. They show that a large angle (45° and 35°) may be overcome and that almost daily improvement is obtained by orthoptic training after the operation.

It is the author's conviction that an advancement should never be performed without a recession of the opposing muscle, even though the recession may have to be only part of the way between the insertion and the equator. (References.)

Edna M. Reynolds.

5

CONJUNCTIVA

Jones, W. Y., Talbot, F. F., and King, W. F. **Stevens-Johnson's disease.** *Amer. Jour. Ophth.*, 1946, v. 29, Feb., pp. 185-189. (2 figures, references.)

Laborne Tavares, C. **Pterygium.** *Rev. Brasileira de Oft.*, 1945, v. 4, Dec., pp. 111-137.

A 27-page review of the literature of the subject, especially as regards the surgical treatment employed by various authors. (Portuguese.) (7 figures, bibliography.)

W. H. Crisp.

Lijó Pavía, J., Lachman, R., and Mendia, J. A. **Phlyctenular kerato-**

conjunctivitis. *Endonasal tuberculin.* *Rev. Oto-Neuro-Oft.*, 1945, v. 20, Jan.-Feb., pp. 1-8.

In a previous report the authors described the use of endonasal tuberculin in phlyctenular conjunctivitis. It was particularly applicable in children and in those adults in whom a minimal systemic reaction was desirable. Four new cases are reported in this communication. The patients were treated as before, beginning with a dilution of 1:100,000 and increasing to 1:10,000. All patients were female, from 8 to 19 years of age, and had pulmonary tuberculosis and phlyctenular conjunctivitis. After therapy there was systemic and ocular improvement. (1 series of drawings.)

Edward Saskin.

Meenan, P. N. **The etiology of trachoma in Ireland.** *Irish Jour. Med. Sci.*, 1945, Nov., p. 670; and Dec., p. 703.

The author presents a preliminary report of an extensive laboratory and clinical study of trachoma in Ireland. He bases his conclusions on the reports of investigators in Ireland and the United States. Most Irish investigators believe that the etiologic agent is a virus rather than a rickettsia. The virus seems to be related to the viruses of psittacosis, lymphogranuloma venereum, and atypical pneumonia. In 49 patients studied, inclusion bodies were found in 19 percent of the eyes in stage I, in 12 percent of those in stage II, and in 5 percent of those in stage III. The author suggests that there may be an unrecognized stage in the life cycle of the virus during which most of the tissue damage is done and in which it might be most susceptible to the sulfonamides.

Morris Kaplan.

Minton, J. **Eye diseases in the East.** *The Practitioner*, 1945, v. 155, Sept., p. 176.

The author served as military ophthalmologist in Iraq, India, and Ceylon and presents his observations and some practical suggestions for treatment of the eye conditions encountered. Great epidemics of virulent conjunctivitis occur twice each year and cause much blindness from severe corneal disease. Many of the patients are children infected by direct contact with other children who have gonorrheal or diphtheritic conjunctivitis. Instillations of sulfapyridine powder in cod-liver oil were given. Trachoma was found in 60 percent of people of all ages. In India, he found a great number of children suffering from vitamin-A deficiency, with serious corneal involvement. In India, an epidemic of punctate keratoconjunctivitis ascribed to virus infections occurs each year. Its morbidity is very high, and treatment is quite unsatisfactory. It is interesting to note the extremely low incidence of these diseases among the Europeans living in the areas. Morris Kaplan.

Paez Allende, F. **Neurofibromatosis of the bulbar conjunctiva.** *Anal. Argent. Oft.*, 1945, v. 6, Jan.-Feb.-March, pp. 6-17.

Neurofibroma may involve the central nervous system, the outer coverings of the body, and the osseous system. In the eye, the skin of the lids may be invaded with a resultant lid ptosis, or the tarsal and bulbar conjunctiva may be the seat of the affection. In a girl, 18 years of age, only the bulbar conjunctiva was involved. Co-existent with the disease, there were epilepsy, corporal asymmetry, intracranial derangement, skeletal lesions, skin tumors, partial alopecia, and a

mild mental retardation. The disease affected the right eye only and involved the bulbar conjunctiva above the limbus up to the caruncle. The lacrimal gland was hyperplastic. A ptosis of the upper lid was present, and there was a punctiform macula in the upper part of the cornea. Vision was reduced to 1/6, and could not be improved. The visual field was within normal limits. Biopsy of the tissue corroborated the diagnosis of neurofibromatosis. The author has considered extirpation of the bulbar growth followed by a buccal mucosa graft. (7 illustrations, bibliography.) Edward Saskin.

Rosen, E. **Heterogeneous conjunctival transplantation.** *Amer. Jour. Ophth.*, 1946, v. 29, Feb., pp. 193-195. (3 figures, references.)

Ventura, Altino. **The surgery of pterygium.** *Rev. Brasileira de Oft.*, 1945, v. 4, Dec., pp. 138-142.

The author deals especially with the conjunctival autoplasty of Paulo, Jr., according to which method over 100 patients have been operated upon in the Recife and other Brazilian clinics. Of these, 52 cases were reexamined at least six months after the operation and are here surveyed. The McReynolds operation, previously employed, had given a slightly higher percentage of recurrences than the Paulo procedure. The paper was discussed by Pedro Falcão, who dismissed the idea that pterygium is produced by chronic inflammation of the nasal or paranasal region or by external irritation from dust and wind; by Moacyr Alvaro, who pointed out that Dimitry of New Orleans has found a greater incidence of pterygium in Louisiana, without wind and dust, than has been reported from drier states of the North Ameri-

can Union; and by several other speakers.

W. H. Crisp.

6

CORNEA AND SCLERA

Blondis, R. R. Superficial pigmentation of the cornea. *Amer. Jour. Ophth.*, 1946, v. 29, March, pp. 316-323 (4 figures, references.)

Bonnet, P. Two new observations on diffuse papillomatous hyperplasia of the cornea developing in old trachomatous pannus. *Jour. d'Ophth.*, 1944, v. 3, No. 3, p. 239.

Two new observations of diffuse papillomatous hyperplasia of the cornea are reported, one in a woman of 47 years with trachoma since the age of 14 years, and the other in a woman of 66 years with trachoma since she was 25 years old. In each case the tumor involved only the cornea. The limbus and bulbar conjunctiva were free. The author believes that chronic irritation is necessary for the formation of these tumors and that in his patients trichiasis was the main source of irritation. He recommends temporary closure of the lids by blepharorrhaphy after extirpation of the tumor to eliminate irritation of the cornea.

Phillips Thygeson.

Bonnet, P. Interstitial keratitis and the Argyll Robertson pupil. *Jour. d'Ophth.*, 1944, v. 3, No. 3, p. 175.

The author states that the Argyll Robertson pupil is the most rare of all the stigmata of congenital syphilis and that the most common pupillary disturbance is internal ophthalmoplegia. He reports the case of a woman, aged 23 years, with congenital syphilis. She had had an interstitial keratitis at the age of 10 and had received regular

antisyphilitic treatment. She showed persistent synechiae. Under the slit-lamp the absence of the light reflex and the presence of a reaction to accommodation convergence were easily demonstrated.

Phillips Thygeson.

Buxton, R. J. Observations on keratoconjunctivitis in military hospitals. *Brit. Med. Jour.*, 1945, Dec. 15, p. 847.

Forty-two cases of keratoconjunctivitis were examined in various military hospitals. The clinical manifestations and treatment are described in detail. The author found a toxic focus in the nose and throat in 40 percent of the patients, and a dental focus in 26 percent. In several cases, the lesion in the eye improved immediately after tonsillectomy or dental extraction. Occasionally an exacerbation of the ocular inflammation followed the removal of the focus of infection, possibly as an allergic manifestation of a bacteriemia.

R. Grunfeld.

Friede, R. Treatment of serious vitreous losses after keratoplastic operations. *Klin. M. F. Augenh.*, 1942, v. 108, Nov.-Dec., p. 717.

When the excision of a keratoplastic flap or of plastic iris membrane is accompanied or followed by the loss of a large quantity of liquefied vitreous an attempt must be made to fill the collapsed bulbus. Injection of physiologic salt solution or of vitreous from calves' eyes has been recommended. Friede found it more practical to increase the fluid content of the whole body by administering large quantities of water by mouth. He observed a very rapid replacement of the lost vitreous. Even after complete collapse of the globe, normal configuration was re-

gained within two to three days. One case is reported. F. Nelson.

Gomensoro, J. B., and Isola, W. The syndrome of blue scleras. *Rev. Oto-Neuro-Oft.*, 1945, v. 20, Sept.-Oct., pp. 111-119.

A case of blue sclerotics in an individual manifesting general debility and bone disease is described. An academic discussion of the blue-sclera syndrome is presented wherein many investigators are quoted. The characteristic changes in the eye are associated with disturbances in other parts of the body such as fractures, deformities, and radiologically demonstrable alteration of bones; weakness of the ligaments; neuro-muscular debility; deafness; endocrine disturbances; arterial hypotension; and syndactyly. The heredity of the syndrome is discussed. Its development is thought to be a result of a disturbed development of the embryonic tissues, particularly those of the mesenchyme, and also of an imbalance of the endocrine system. Treatment is essentially symptomatic, although thyroid and anterior pituitary extract have been administered with equivocal results. (References.) Edward Saskin.

Harley, R. D. Ocular leprosy in Panama. *Amer. Jour. Ophth.*, 1946, v. 29, March, pp. 295-316. (19 figures. references.)

Illig. The use of digestive ferments in serpiginous corneal ulcer. *Klin. M. f. Augenh.*, 1942, v. 108, Sept.-Oct., pp. 618-620.

In this brief preliminary report the author discusses the possible usefulness of ferments in the treatment of corneal ulcer. He did some experimental work with rabbits and treated a few patients. He used pancreatic

ferment because it is active in an alkaline medium. A standard ointment used in dermatology is tolerated by the normal eye without signs of irritation. In an aged woman whose eye was considered all but lost because of a serpiginous corneal ulcer, the ulcer became clear after three applications of pancreatic-ferment ointment, and the eye healed in a few days more. In two other women, the eyes reacted equally favorably.

Pancreatic ferment does not affect the intact cornea, but promptly dissolves necrotic corneal tissue. Pneumococci were either killed by the ferment or rendered avirulent. F. Nelson.

Mendonça de Barros, J. Ocular complications of leprosy. *Amer. Jour. Ophth.*, 1946, v. 29, Feb., pp. 162-171. (5 figures, discussion.)

Minton, J. Eye diseases in the East. *The Practitioner*, 1945, v. 155, Sept., p. 176 (see *Conjunctiva*, Section 5).

Morate, F. H. Acute keratitis fugax. *Rev. Oto-Neuro-Oft.*, 1945, v. 20, June-July, pp. 62-65.

In a sanatorium for bacillary diseases, 27 patients suddenly developed an acute, transitory keratitis. No etiologic agent was isolated, and it did not seem likely that the lesion was a manifestation of a reaction to an allergen or a therapeutic agent. The lesion was usually visible for about nine hours; the subjective symptoms lasted but a few minutes. The pericorneal injection was most marked at the 3- and 9-o'clock locations; the corneal infiltration was usually punctate though it was occasionally linear, and corneal defects could be stained with fluorescein in one half of the eyes; diminished corneal sensibility lasted for a few

minutes to a few days. Systemic treatment with gold given before the onset of the keratitis did not cause a recurrence of symptoms. No treatment was ordered because of the fleeting nature of the disease. Edward Saskin.

Paufique, L., and Bonamour, G. A new case of keratitis due to varicella. *Jour. d'Ophth.*, 1944, v. 3, No. 3, p. 255.

A young girl, recovering from varicella, developed deep parenchymatous keratitis at a time when the last skin lesions were disappearing. The keratitis was limited to the inferior temporal quadrant of the cornea and was associated with large folds in Descemet's membrane and a few corneal precipitates. There was no iris lesion. Symptoms were minimal, but vision was reduced to 1/3 and was not correctable in the affected eye. The vision of the other eye was 10/10. The keratitis was characterized by its sluggish course. The resemblance to the keratitis of herpes zoster was noted.

Phillips Thygeson:

Roper, K. L. Senile hyaline scleral plaques. *Arch. of Ophth.*, 1945, v. 34, Oct., pp. 283-291.

Senile hyaline scleral plaques must be regarded as a clinical entity characterized by the absence of clinical symptoms. The plaques are situated about 3 mm. from the limbus and 1.5 mm. to 2 mm. anterior to the insertions of the rectus muscles. They are generally rectangular but occasionally may be rounded or oval. They are most commonly seen opposite the insertion of the internal rectus muscle but occur next in frequency opposite that of the external rectus muscle. Rarely have they been observed opposite the insertion of the inferior rectus muscle. The patches appear to be somewhat

depressed. The sclera in these plaques seems to be even more rigid and resistant than average. On transillumination of the globe, the areas show as relatively clear and translucent windows. The condition apparently is not a hazard to the eye.

Advanced age is largely responsible for predisposition to the disease, since in the aged dehydration and progressive sclerosis of the connective tissue of the entire body occur. It is probably the result of a local nutritional disturbance, which, in turn, is due to arteriosclerotic changes.

The author reports five cases personally observed. There is a detailed review of the literature and a discussion of the anatomic and physiologic characteristics of the sclera. (14 photographs.) John C. Long.

Smelser, G. K., and Ozanics, V. Effect of local anesthetics on cell division and migration following thermal burns of cornea. *Arch. of Ophth.*, 1945, Oct., v. 34, pp. 271-277.

The influence of local anesthetics on the healing processes of the cornea was studied in the rat. The effect of the drugs on mitosis and cell migration of the corneal epithelium was investigated. Topical application of most anesthetics inhibits mitosis in the intact corneal epithelium when used in concentrations which produce anesthesia. The inhibition of cell division varies with different drugs, and with the method and frequency of administration. The processes of cell migration and cell division are affected differentially: cell migration may be notably retarded with little or no inhibition of cell division; other drugs inhibit mitosis but do not markedly retard cell migration. These variations make it difficult briefly to summarize the action

of the various agents. The drugs tested included solutions of cocaine hydrochloride, tetracaine (pontocaine) hydrochloride, nupercaine hydrochloride, phenacaine (holocaine) hydrochloride, butacaine sulfate, Chlorobutinal and metycaine hydrochloride. Ointments containing butyl aminobenzoate (butesin), orthoform, butacaine (butyn) sulfate, metycaine and tetracaine were used. It was found that unbuffered aqueous solutions inhibit the healing processes far more than do ointments of the same or greater strength which produce anesthesia of longer duration. Nupercaine and phenacaine ointments produce prolonged surface anesthesia and do not impair mitosis in the normal epithelium, or retard cell division or migration in regenerating corneal epithelium. John C. Long.

7

UVEAL TRACT, SYMPATHETIC
DISEASE, AND AQUEOUS
HUMOR

Barlow, A., and Weiner, H. L. Traumatic iridodialysis: its surgical correction. *Arch. of Ophth.*, 1945, v. 34, Oct., pp. 292-294.

The authors report the successful correction of a large traumatic iridodialysis by a method devised by Jameson. (1) A curved threaded needle is inserted into the anterior chamber through the sclera posterior to the limbus. As the needle enters the chamber it transfixes the torn iris root and is then brought out through the cornea. (2) A limbal keratome incision is made through which the thread anterior to the iris is grasped and pulled through the corneal wound. (3) The thread is tied, which brings the torn base of the iris back to the sclerocorneal junction. In the case described two threads were

used so as to form two sites of attachment to the sclerocorneal junction. The technique is illustrated.

John C. Long.

Fronimopolulos, Johann. The pathogenesis of serous detachment of the choroid. *Klin. M. f. Augenh.*, 1942, v. 108, Nov.-Dec., p. 665.

The occurrence of serous detachment of the choroid after operations for cataract and glaucoma has long been known. Its pathogenesis has been the object of research by many investigators and numerous theories have been published. The author used a 1.5 mm. trephine to produce artificial scleral and corneal fistulas in the eyes of young rabbits and dogs. Vitreous fistulas always produce an acute hypotony and deepening of the anterior chamber. The minimum decrease of tension was obtained earlier in dogs' than in rabbits' eyes. If the eyes were trephined a second time after complete recovery the hypotonic maximum was reached much earlier than after the first operation. On one group the operation was performed without anesthesia. A choroidal detachment could not be observed in any eye with vitreous fistula. The eyes usually returned to normal in eight days. The fistula was found completely closed after two weeks. Corneal fistulas were obtained by opening the anterior chamber with a keratome and punching a hole in the periphery of the cornea with Vacher's iris punch. This averts hemorrhage into the chamber, which may obscure the ophthalmoscopic picture. Iris prolapses were replaced with a spatula. The iris-lens diaphragm was always pushed forward because of the ensuing negative pressure in the anterior chamber. A sequel of the resulting hypotony was noticeable hyperemia and occa-

sionally hemorrhage in the choroid. In two thirds of all eyes with corneal fistula a choroidal detachment was observed ophthalmoscopically after about half an hour. In the remaining eyes the fundus was not seen because of hemorrhage from the iris. The onset of hypotony in these artificial vitreous fistulas was retarded by the use of cocaine and novacaine combined with adrenalin. The author believes that the continuous pull on the peripheral parts of the ciliary body causes tiny detachments. As a result of the negative pressure, transudation from the hyperemic choroidal vessels ensues, which eventually leads to the ophthalmoscopically visible choroidal detachment. (63 illustrations, references.) F. Nelson.

Lijó Pavía, J., and Lachman, R. **Congenital aniridia; three cases.** *Rev. Oto-Neuro-Oft.*, 1945, v. 20, Aug., pp. 79-85.

Congenital aniridia may be complete or incomplete, unilateral or bilateral, and is associated with photophobia and diminished visual acuity. Pseudoptosis, microphthalmos, nystagmus, microcornea, corneal opacities, very deep anterior chamber, persistent pupillary membrane, ruptured suspensory ligament, lens opacities or subluxation, vitreous opacities, persistent hyaloid artery, optic atrophy, and fundus depigmentation, are occasionally associated with this congenital anomaly.

Three cases are reported. In the first there was bilateral total aniridia with nystagmus and lens changes; in the second there was total aniridia in one eye, almost total aniridia in the other, pseudoptosis, nystagmus, and excavation of the disc; in the third, a total unilateral aniridia was associated with pseudoptosis, nystagmus, and a pale fundus, while the fellow eye had a

normal iris, ectropion, and a senile cataract. (2 illustrations, references.)

Edward Saskin.

Rosen, Emanuel. **Rupture of choroid associated with cyst of vitreous.** *Brit. Jour. Ophth.*, 1945, v. 29, Sept., pp. 486-489.

Injury to the right cornea of a colored male resulted in reduction of vision to 20/200, which could not be improved by refraction. The pupil of the right eye was larger than that of the left and the temporal half of the pupil responded to light and accommodation more promptly than did the nasal half. Slitlamp examination showed a small superficial horizontal scar across the pupillary area of the cornea. The iris showed a definite break in its sphincteric portion at the 3-o'clock position.

The fundus showed a choroidal tear in the macular region running vertically and about three disc diameters in size. Below the disc was a cystic structure $2\frac{1}{2}$ times the size of the disc and shaped like an apple. This sphere seemed to be loosely suspended from a pedicle. As the patient looked upward, the mass would disappear, but upon his looking downward, it would settle back into its original position.

About a month after the first examination, the cyst was found to be ruptured, and the vitreous later showed some signs of clearing.

A similar case of vitreous cyst in a colored female is reported. There was rupture of the cyst with subsequent formation of a macular hole.

The author believes the tendency to excessive proliferation and encapsulation of tissue, as observed among Negroes, is responsible for traumatic cysts of the vitreous. (4 illustrations.)

Edna M. Reynolds.

Spyratos, S. The precursors of melanin as virulent nucleoproteins in the eye, with particular reference to sympathetic ophthalmia. *Klin. M. f. Augenh.*, 1942, v. 108, Sept.-Oct., pp. 605-614.

The pigment in all pigment cells consists of protein granules to which the melanin is firmly bound. In the earliest stages of pigment formation these granules are colorless and consist of undifferentiated protein. Later they are transformed into black melanin granules under the influence of a pyrocatechin derivative in the presence of an oxidative ferment which is found in the immature-protein granules. In the eye this transformation normally takes place only in a certain period of embryonic life. When the pigment genesis is complete, the melanoblasts become chromatophores and normally continue in this function for life. Under abnormal conditions, melanophores may react with degeneration and dissolution of the cells and with pathologic proliferation of pigmented epithelial cells. Atypical embryonic melanoblasts form, in which abundant immature atypical protein granules, the precursors of pigment, occur, not only within the cell itself but also in the surrounding tissue. The question arises whether these protein granules are able to interfere with the biologic balance of the melanophores in the healthy fellow eye, and eventually lead to the formation of the same immature protein bodies. The author found a direct relationship between these granules, on the one hand, and the epithelioid cells and infiltration nodules of sympathetic ophthalmia, on the other. Under pathologic conditions *in vivo* and in tissue culture *in vitro*, the pigment granules are engulfed by phagocytes as foreign bodies. The be-

havior of pigmented epithelial cells and of the chromatophores of the choroid is different. The latter settle around the blood vessels in a characteristic way. Under pathologic conditions they are able to invade blood vessels. Free pigment granules are then found not only in the lumen but also in the endothelium of the vessel. Pigment epithelial cells may pass the barrier of the lamina vitrea and proliferate in the uvea and even cover organized masses of exudate. In histologic preparations impregnation with silver makes mature pigment granules as well as their colorless precursors visible. With this staining method a direct relationship between free pigment granules and the epithelioid cells found in sympathetic ophthalmia could be established. The granules are found abundantly engulfed by the epithelioid cells. The author conducted numerous experiments with tissue cultures to clarify the reactions of the cells of the organism to free pigment granules. The pathogenic effect of the melanin granules and especially of the precursors of melanin in sympathetic ophthalmia seems to be firmly established. They act as virulent proteins like microbes or viruses. (6 photomicrographs, bibliography.)

F. Nelson.

Town, A. E., and Hunt, M. E. Penicillin in the aqueous humor. *Amer. Jour. Ophth.*, 1946, v. 29, Feb., pp. 172-175. (3 figures, references.)

8

GLAUCOMA AND OCULAR TENSION

Awerbach, M. L. Cyclodiathermy in secondary glaucoma. *Amer. Rev. Soviet Medicine*, 1945, v. 3, Oct., p. 35.

A general report of the results of 52 cyclodiathermy operations on 49 patients is presented. The author believes

that coagulation of the ciliary body is a safe procedure and reports satisfactory results. The procedure is simple and can be followed by other procedures when it proves ineffective.

Morris Kaplan.

Arruga, H. **Optico-ciliary neurotomy as a treatment for expulsive hemorrhage.** *Ophthalmologica*, 1943, v. 105, Feb., pp. 106-107.

A patient with painful absolute glaucoma refused enucleation. A retrobulbar injection of alcohol relieved the pain temporarily. A Lagrange operation with iridectomy was started, when an expulsive hemorrhage occurred. Immediate trephining of the sclera was ineffective. Optico-ciliary neurotomy was then performed. The hemorrhage ceased; the eyeball preserved its form; the pain did not recur.

Alice R. Deutsch.

Bhalerao, C. K. **Glaucoma.** *The Anti-septic*, 1945, v. 42, Dec., p. 706.

The author reviews glaucoma for the general practitioner of India. Several unusual ideas are presented. He believes that surgery should be done in acute congestive glaucoma if the tension remains high after two hours of medical treatment, and that in chronic glaucoma medical treatment is of no value.

Morris Kaplan.

Bonnet, P. **Congenital aniridia and chronic glaucoma.** *Jour. d'Opht.*, 1944, v. 3, No. 3, p. 169.

Bonnet reports a case of bilateral chronic glaucoma, in which there was a total aniridia of the left eye. Although the glaucoma of the left eye manifested itself first and progressed to complete loss of vision, the glaucoma of the right eye was almost equally severe. There was no favorable response to

miotics. The author believes that there may have been a developmental anomaly in the right eye to account for the glaucoma. Phillips Thygeson.

Gallois, Jean. **Nicotinic acid in ophthalmology and the principle of minimal elective vasodilation.** *Arch. d'Opht.*, 1945, v. 5, No. 2, p. 197.

According to Gallois, the use of a vasodilator always carries a certain risk. Acetylcholine has frequently produced elevation in tension in mildly glaucomatous eyes. He has used nicotinic acid with satisfaction. It gives a vasodilation without modification of the arterial pressure and can be used either by mouth or by intramuscular or intravenous injection. He reports a series of 29 patients with chronic glaucoma in which the use of the drug resulted in significant lowering of the tension and increase in visual acuity and fields. In nine patients results were unfavorable. The favorable results were obtained in glaucoma at onset, glaucoma of slow evolution, and glaucoma with only slightly elevated tension. An individual oral dose of 30 mg. was usually satisfactory. General and local reactions could be expected within an hour. The treatment was given daily for three days of each week. Occasionally it was necessary to reduce the doses to 20 or even to 10 mg.

Phillips Thygeson.

Guerry, D. III. **Congenital glaucoma after maternal rubella.** *Amer. Jour. Ophth.*, 1946, v. 29, Feb., pp. 190-193. (References.)

Lutman, F. C. **Diathermy for the treatment of glaucoma.** *Amer. Jour. Ophth.*, 1946, v. 29, Feb., pp. 180-184. (Table, references.)

Marchesani, O. *Ophthalmomalacia* (essential hypotony). *Klin. M. f. Augenh.*, 1942, v. 108, Nov.-Dec., p. 692.

The author describes three cases of typical essential hypotony with linear opacities in the cornea. In a man, 18 years of age, whose right eye had been enucleated because of unbearable pain and progressive atrophy six months before, the left eye became similarly affected. The eye was inflamed and photophobic, and the cornea had gray subepithelial irregular linear opacities. The corneal parenchyma was clouded, and the tension was very low. During five weeks of hospitalization, improvement of all symptoms was observed; three weeks later there was a recurrence. Histologic examination of the right eye revealed pronounced thickening of the corneal stroma and epithelium at the site of the linear opacities. Iris and ciliary body were edematous. In the second patient, a man 33 years of age, a typical linear keratitis in the right eye was associated with hypotony and symptoms of a sympathetic paresis on the right side. He recovered fully without treatment and a recurrence four weeks later in the left eye healed within three weeks. The third patient, a man 44 years of age, was injured in a motorcycle accident. The right eye was destroyed completely, the skull and some other bones were fractured. There was right-sided Bell's palsy. The left eye had suffered contusion. The initial intraocular pressure was unmeasurably low, there was a temporal hemianopsia, and pallor of the disc. The visual acuity eventually improved to 5/15. To explain the pathogenesis of the ophthalmomalacia the author postulates a disturbance of the exchange of the intraocular fluid

which is opposite to that of primary glaucoma. In these patients capillary microscopy of the fingernail beds usually reveals a disturbance of the capillary circulation, and the blood pressure is low. (1 color plate, 4 photomicrographs, 2 capillary photomicrographs, bibliography.) F. Nelson.

Redslob, E., and Delbos, R. *Sympathetic ophthalmia without manifest exciting inflammation*. *Ophthalmologica*, 1943, v. 105, Feb., pp. 83-90.

An unusual sympathetic ophthalmia gives the opportunity to discuss Redslob's theory concerning the pathogenesis of this disease.

A left eye with a double traumatic perforation developed a severe purulent iridocyclitis immediately after the accident. The eyeball became pale, and there were signs of early shrinkage. No corneal precipitates were visible. An unexplained orbital pain remained. Three months later, a low-grade iridocyclitis with corneal precipitates developed in the uninjured eye and caused considerable impairment of vision. The injured eye was enucleated at once. A nonspecific inflammation was found in the neighborhood of the wound, and there was sympathizing ophthalmitis in the posterior part of the choroid.

To explain these findings the authors refer to Redslob's theory of the pathogenesis of sympathetic ophthalmia. The etiologic agent of the sympathetic ophthalmia is believed to invade the perforating wound with its enclosed uveal tissue. Here it causes a primary focus of inflammation. An inactive period follows during which the uvea becomes sensitized to uveal tissue. The sensitizing agent reaches the choroid through the short posterior ciliary arteries, and the iris and ciliary body

through the long posterior ciliary arteries.

In the present case the long posterior ciliary arteries were spared, and the iris and ciliary body were not affected; therefore, a clinical diagnosis in the injured eye was not possible. There were no characteristic changes in the anterior part, and the fundus could not be seen. The severe orbital neuralgia which disappeared after enucleation might be a suggestive diagnostic sign.

Alice R. Deutsch.

Reese, A. B. The iridencleisis operation for glaucoma. *Arch. of Ophth.*, 1945, v. 34, Nov.-Dec., pp. 360-368.

The feeling prevails to some extent that it is not a sound surgical procedure to incarcerate iris tissue deliberately for the relief of glaucoma when on all other occasions an effort is made to prevent such an occurrence.

On Reese's service the operation has been performed on 110 eyes, during the past three years, and this report is based on the experience encountered in that series of consecutive operations.

An incarceration of prolapsed iris may be good or bad, depending on the manner in which it occurs. After an operation, especially a cataract extraction, an incarceration may lead to a filtering cicatrix or to secondary glaucoma. If the iris is incarcerated as a wick of tissue with the surfaces of the pigment epithelium together, it is more likely to produce a filtering cicatrix.

When an iridotaxis is done, the sphincter muscle pulls the pupillary border of the iris partly back into the anterior chamber. This leaves a pocket of iris which blocks the wound increasingly because of its progressive dilation by the aqueous. This can best be prevented by cutting the sphincter

muscle, extending the radial incision in the iris to the very periphery of the iris, and there leaving no portion of the root of the iris over the site of the coloboma.

The technique here described incorporates these factors.

A keratome section is made under a large conjunctival flap. The point of the keratome engages the conjunctiva at least 10 mm. from the limbus, and the conjunctiva is dragged down over the point of the keratome to the point of scleral puncture. Three-fourths the length of the keratome blade is introduced into the anterior chamber, and the conjunctival opening is enlarged on each side with a scissors. The operator withdraws the iris by grasping it at the pupillary margin. An assistant holds the iris on the opposite side, and in unison they withdraw the iris until an iridodialysis is just noted. Then a radial cut is made through the iris into the iridodialysis opening. The assistant releases the iris, and the operator then incarcerates each pillar into the corner of the wound with a minimum of manipulation. The conjunctiva is closed with interrupted silk sutures. Drops are not instilled.

The most important step in the operation is a correct incision. This should be made far back so that the point of the keratome enters the anterior chamber in or close to the chamber angle.

The operation is effective primarily because the wicks of iris produce a vicarious filtering sluiceway, but also because the iridodialysis frees the chamber angle over the coloboma area. This gives the effect of a basal iridectomy. When the iris is pulled up and out of the wound above, the iris below is stretched, which widens the angle and prevents the iris from blocking the

filtration angle. This widening of the angle below can be observed by gonioscopic examination.

Iridencleisis produces less drainage. It is therefore indicated when the maximal tension is less than 50 mm. Hg (Schiotz), and the basal pressure is 30 mm. Hg or less.

When one or more operative procedures have failed, the use of iridencleisis has not proved satisfactory.

When Reese advises surgery for glaucoma in an eye which still has normal vision and a normal field he prefers that there be not only an excellent chance of arresting the disease but that there is negligible danger of complications. This is definitely true of iridencleisis.

Sympathetic inflammation has not appeared in this series. He believes, however, that the incidence of sympathetic inflammation must be somewhat higher after iris-inclusion operations than after other intraocular operations.

The article is followed by valuable discussion. (Nine figures.)

R. W. Danielson.

Tartar, J. How do the hormones of the posterior lobe of the pituitary gland affect glaucoma? *Klin. M. f. Augenh.*, 1942, v. 108, Nov.-Dec., p. 737.

Recent investigations have shown that the regulation of the intraocular pressure depends partly upon the function of certain endocrine glands. Many different endocrine preparations, among them meropitan, which is an extract of the posterior lobe of the pituitary, have been used successfully to reduce the intraocular pressure in simple glaucoma. The author observed more than 100 cases of glaucoma, 45 of them simple glaucoma, 3 acute inflammatory glaucoma, 24 chronic inflammatory

glaucoma, 15 absolute glaucoma, 4 juvenile glaucoma, and 5 postoperative glaucoma. Some of them had not been treated with any miotics previously, in others there had been continuously high tension in spite of the use of miotics. He used pituisan, which contains all the hormones of the posterior lobe, oxytocin, and vasopressin. The extracts were administered either subconjunctivally or intramuscularly. Oxytocin and vasopressin appeared to be ineffective. In 24 cases decrease of the tension was obtained, in eight a very sudden drop. Absolute glaucoma, juvenile glaucoma, and acute inflammatory glaucoma did not respond to posterior-lobe extract. Simple and chronic inflammatory glaucoma responded best, but the response was usually of short duration and rarely permanent. When the glaucoma was probably a manifestation of an endocrine disturbance, results were most striking. (1 chart, bibliography.) F. Nelson.

Troncoso, M. U., Diathermy in glaucoma. *Amer. Jour. Ophth.*, 1946, v. 29, March, pp. 269-290. (18 figures, references.)

Weekers, Roger. Incomplete glaucoma. A contribution to the study of glaucoma without hypertension. *Ophthalmologica*, 1942, v. 104, Dec., pp. 316-331.

Changes in the intraocular vessels are responsible for the symptom complex called chronic idiopathic glaucoma, whose classical signs and symptoms—namely, hypertension, glaucomatous cupping, and the typical constriction of the visual fields—are caused by changes in the blood vessels of the uvea, optic nerve, and retina.

There are cases of glaucoma in

which there are a pathologic cupping and a characteristic constriction of the visual fields but normal ocular pressure. Wiekens refers to glaucoma without hypertension "incomplete glaucoma." Cases of optic trophy with excavation but without hypertension and without the typical defects in the fields he calls "monosymptomatic glaucoma."

Personal observations and cases from the literature are discussed. (4 figures, references.) Alice R. Deutsch.

9

CRYSTALLINE LENS

Albaugh, C. H. Congenital anomalies following maternal rubella. *Jour. Amer. Med. Assoc.*, 1945, v. 129, Nov. 10, p. 719.

Conclusions are drawn from 78 cases of maternal rubella during pregnancy, previously reported, to which the author adds nine. All of the babies whose mothers were infected with rubella during the first two months of pregnancy and one half of those whose mothers were infected during the third month had congenital anomalies. The commonest lesions were cataract, defects of the cardiac septum, patent ductus arteriosus, deaf-mutism, and microcephaly. It is suggested that all girls be exposed to rubella before maturity. An effective vaccine is desirable. The propriety of legal abortion should be discussed. Morris Kaplan.

Bonfioli, A. Sutures in the cataract operation. *Rev. Brasileira de Oft.*, 1945, v. 4, Dec., pp. 149-175.

The author describes and illustrates the sutures employed by various operators, and concludes by describing the special scleroconjunctival suture used in the ophthalmic clinic of the São

Geraldo Hospital of Belo Horizonte. He considers that cataract operation demands a sclerocorneal suture for safety and efficiency. (Numerous illustrations, bibliography.) W. H. Crisp.

Cole, H. N., Giffen, H. K., and others. Congenital cataracts in sisters. *Jour. Amer. Med. Assoc.*, 1945, v. 129, Nov. 10, p. 723.

Congenital ectodermal dysplasia in two sisters aged 10 and 22 months is described. These are unique in that all of the ectodermal tissue is involved. There was bilateral congenital cataract and severe internal strabismus.

Morris Kaplan.

Girardet, M. Another family with central pulverulent cataract. *Ophthalmologica*, 1943, v. 105, Jan., pp. 24-36.

The clinical appearance and the mode of transmission of a hereditary, central cataract in an afflicted family are discussed.

The cataract manifests itself as a central, punctate opacity which has slight morphologic variations so that four different groups can be distinguished.

1. A discoid opacity in the embryonic nucleus with a clear central interval as described by Poos.

2. A discoid, sharply outlined opacity in the embryonic nucleus with coarse punctate opacities in the central interval as described by Vogt.

3. A combination of the manifestations of 1 and 2.

4. Special atypical opacities which consist of a delicate circle superimposed on a dense, irregular Y.

When these malformations appear in their characteristic forms, similar to their ancestral genotype, they follow the law of dominant heredity. The atypical forms are not hereditary. It is

presumed that their appearance is a sign of a change in the transmitting gene. (5 figures, references.)

Alice R. Deutsch.

Hymes, Charles. Scleral flap incision with scleral sutures for the cataract operation. *Arch. of Ophth.*, 1945, v. 34, Nov.-Dec., pp. 374-377.

In order to overcome all the handicaps of other types of sutures and at the same time to afford firm and exact apposition of the lips of the wound, the technique of the scleral-flap incision and scleral suture was devised. A description follows:

A small conjunctival flap of about 3 mm., is dissected over the upper half of the cornea to the limbus. The eyeball is fixed with a scleral pick, and the scleral flap is made by means of a scleral knife which is concave anteriorly, or by a Lundsgaard knife. The incision starts 1 to 1.5 mm. above the limbus, and the scleral knife is kept at a shallow level while the incision is made, in order to avoid cutting through the sclera, which at this place is 0.5 mm. thick. The knife is carried toward the limbus and stops short of opening the eyeball.

A fine black-silk suture on a sharp, curved atraumatic needle is passed through the conjunctival flap, the tip of the scleral flap, and the corresponding portion of the upper scleral lip and, finally, the edge of the bulbar conjunctiva, above. The loop is drawn aside to permit the making of the incision.

When the scleral flap is turned downward toward the cornea, an interval of 1.5 to 2.5 mm. is created between the two parts of the suture, the size depending on the height of the scleral flap. This leaves ample space for the cataract knife to pass without the risk of cutting the suture. For additional

accuracy, however, Hymes prefers to use the keratome and scissors in making the incision.

Should the anterior chamber be very shallow, as in a case of glaucoma combined with cataract, an ab externo incision may be made.

On completion of the extraction, the scleral suture is firmly tied, and two or more auxiliary conjunctival sutures are placed. (8 figures.) R. W. Danielson.

Irvine, R. S. Removal of the dislocated lens under a conjunctival pocket flap. *Arch. of Ophth.*, 1945, v. 34, Nov.-Dec., p. 398.

Irvine has developed and used in 10 cases a technique emphasizing the following features: a vertical incision of the conjunctiva, about 13 mm. long, beginning 5 mm. from the limbus, at the 9-o'clock position in the left eye and at the 3-o'clock position in the right eye; wide separation of the conjunctiva over the upper half of the globe; opening of the anterior chamber, with a keratome incision, under the everted edge of the flap; completion of the section, with scissors, under the flap; extraction of the lens with the loop; depressing the sclera under the flap, and a water-tight closure of the incision.

Irvine has been surprised at the small loss of vitreous. His only explanation is that the positions of the conjunctival and corneal incisions do not coincide. R. W. Danielson.

10

RETINA AND VITREOUS

Bonnet, P., Chauvire, E., and Gallet, M. A case of methyl-alcohol poisoning with amelioration by stellate ganglion block. *Jour. d'Opht.*, 1944, v. 3, No. 3, p. 220.

The authors report the case of a man aged 54 years, who became suddenly blind following the imbibing of methyl alcohol. When first seen the patient had no light perception. The pupils were dilated and fixed to light but reacted to accommodation-convergence. There was edema of the nervehead and retina. The urine contained albumin which disappeared in 48 hours. Treatment consisted in (1) daily stellate ganglion blocks alternately on the right and left, (2) daily subcutaneous injections of strychnine, and (3) daily intravenous injections of acetylcholine and "bevitine." Light perception returned on the seventh day. Two days later vision was $1/6$ in the right eye and $1/100$ in the left, with improvement to $1/2$ and $1/15$, respectively, 48 hours later. The final visual acuity obtained was right $2/3$ and left $1/15$, with a normal visual field in the right eye but a large central scotoma in the left.

The authors call attention to the late appearance of spasm of the retinal vessels in this patient. They believe that the stellate ganglion blocks were of value in minimizing the vascular phenomena, which they consider a very important factor in methyl-alcohol intoxications. Phillips Thygeson.

Bonnet, P., Paufigue, L., and Bonamour, G. Detachment of the retina and tuberculosis. Military tubercles, periphlebitis, and retinal detachment. *Jour. d'Opht.*, 1944, v. 3, No. 3, p. 210.

The authors report the case of a man 58 years of age with a detachment of the upper temporal part of the retina of the left eye and multiple tubercular lesions widely scattered over the fundus. Visual acuity was $2/10$. Physical examination showed an old fibrous pulmonary tuberculosis. The retina

was reattached by diathermy coagulation.

They also report the case of a man 39 years of age with a retinal detachment of the right eye involving the entire lower half of the retina. Vision was reduced to $1/8$. The superior temporal vein showed a periphlebitis, and in this quadrant there were multiple foci of choroiditis with connective-tissue proliferation. Periphlebitis of the retinal veins was also noted in the left eye. General physical and radiologic examination revealed no evidence of pulmonary or other tuberculous lesions, but the authors consider that the ocular lesions were probably tuberculous in nature.

They stress the value of meticulous examination of the apparently normal eye in all cases of retinal detachment.

Phillips Thygeson.

Bonnet, P., and Paufigue, L. Thrombosis of the central retinal vein, or of its branches, due to syphilis. *Jour. d'Opht.*, 1944, v. 3, No. 3, p. 172.

The authors note that syphilitic involvement of the retinal veins is rare. They report four cases of thrombosis due to syphilis recognized by clinical and serologic signs and by therapeutic response.

The first patient, 60 years of age, had a typical thrombosis of the central retinal vein with edema, hemorrhages, and a vision of $3/10$. The Wassermann and Kahn reactions were strongly positive. Muthanol was used in treatment, with a progressive return of vision and a rapid diminution in the retinal signs. A return to a vision of $10/10$ was obtained without residual changes in the fundus.

The second patient, 51 years of age, had a thrombosis of the inferior retinal

veins. Blood tests for syphilis were positive. Specific treatment resulted in complete healing in three months.

The third observation was of a woman 32 years of age who had a thrombosis of the superior temporal vein of the right eye with a vision of 4/10. Specific treatment resulted in rapid improvement; four months later vision was normal and the fundus appeared normal.

The fourth patient, a man 46 years of age, showed the typical picture of thrombosis of the central vein, although his vision was still 10/10. He gave a history of syphilis discovered 10 years previously, treated regularly, and pronounced cured after seven years. The Wassermann and Kahn reactions were negative. Nevertheless specific treatment was started and improvement was slow but satisfactory.

The characteristics of syphilitic thrombosis are described by the authors after a review of the literature as consisting in (1) pronounced dilatation and tortuosity of the retinal veins, (2) striking response to specific treatment, (3) absence of arterial hypertension, and (4) lack of marked diminution in visual acuity.

Phillips Thygeson.

Espildora Luque, C. Recurrent retinal detachment. *Arch. Chilenos de Oft.*, 1945, v. 1, March-April, pp. 25-27.

In a man, aged 43 years, there was a persistent tendency to recurrence of the detachment in various parts of the upper segment of the retina, without any invasion of the macular region or of the lower half of the retina. Reappearance of the detachment occurred in a zone, already cauterized, which became reattached after a second intervention. The eye tolerated four opera-

tions without complication, in spite of the fact that the other eye was in a maximal condition of pthisis bulbi after a single operation for the same retinal condition. The amount of myopia in the eye whose upper sector had been so frequently and extensively cauterized underwent no change.

W. H. Crisp.

Freusberg, O. Fundus lesions in spotted typhus. Preliminary report. *Klin. M. f. Augenh.*, 1942, v. 108, Sept.-Oct., p. 621.

The author gives a preliminary report of fundus lesions in spotted typhus observed at the Russian war front. Abnormalities of the eyeground were found in 15 to 20 percent of all patients. He describes three characteristic cases. All had a more or less pronounced papilledema, retinal edema, and perivascular nodules. Considerably rarer were small choroidal lesions which left pigmented atrophic areas when healed. The fundus changes occurred during the period when the exanthem reached the highest point between the fifth and ninth day after onset of the disease. At the end of the third week fundus changes were usually not found, with the exception of the papilledema, which gradually disappeared during the period of convalescence. A complete report with histologic findings will appear later.

F. Nelson.

Lijó Pavia, J. Alterations of the hypophyseal region. Treatment with gonadotropin. *Rev. Oto-Neuro-Oft.* 1945, v. 20, June-July, pp. 53-61.

Three patients are presented in whom hypophyseal derangements were suspected following fundus and visual-field studies. All had a markedly di-

minished visual acuity and a contraction of the field which was usually irregularly concentric. Fundus studies revealed arterial narrowing, and a retinopathy characterized by atrophy of the inner layers of the retina, especially in the macular area. On the basis of the observations of several investigators and on roentgenograms of the sella turcica, the author ascribed these conditions to hypophyseal alterations. He prescribed sex hormones to restimulate the circulation, especially in the retinal arterioles and the choroidal vessels. Some improvement of visual acuity is reported. (7 retinographs, references.) Edward Saskin.

Paufique, L., and Bonamour, G. The prognosis of retinal-detachment operations in myopes. *Jour. d'Opht.*, 1944, v. 3, No. 3, p. 199.

In a series of 200 retinal detachments the authors observed 89 in myopic eyes. The right eye was involved slightly more frequently than the left, and detachment was slightly more frequent in myopic females than in myopic males. In most cases there was only one retinal tear, and this was frequently located in the upper temporal quadrant. Detachments in myopia greater than 10 diopters occurred almost exclusively before the age of 50 years; in eyes with a myopia of less than 10 diopters they usually occurred after 50 years of age.

Of the 89 patients nine were not treated, seven because of obvious contraindications such as thrombosis of the central vein and active chorioretinitis. In the 80 surgical operations the authors obtained 59 reattachments and had 21 failures. Six of the reattachments required reoperation because of recurrence.

Of the 21 failures, 10 were in indi-

viduals over 60 years of age. Vitreous hemorrhage occurred in four of these and in three there were gross tears with floating flaps which could not be obliterated at operation. In the other three no ocular reason for failure could be determined, but the patients were all suffering from severe arterial hypertension. Of the 11 failures in patients below the age of 60 years, two had myopia of more than 20 diopters with total detachments complicated by multiple tears; two were in patients with severe posttraumatic detachment, one complicated by subluxation of the lens and the other by vitreous hemorrhage; two were in individuals over 70 years of age; one was in an old detachment without visible tears; and one was in a patient with total detachment and numerous tears near the ora serrata extending over three-fourths of the retinal circumference. Finally, there were three cases which were considered clinically to have a favorable prognosis but in which healing did not follow.

In the 59 patients with reattachment there were only three in which a vision of less than 1/10 was obtained. Six had between 1/10 and 2/10, 30 had between 2/10 and 5/10, and there were 10 with an acuity above 5/10. The authors conclude that they would have had an operative success of 93 percent if the figures were revised to eliminate the truly inoperable and the aged myopic eyes in which detachment could be considered more arteriosclerotic than myopic. Phillips Thygeson.

Paufique, L., and Bonamour, G. Thrombosis of the central retinal artery in a child. *Jour. d'Opht.*, 1944, v. 3, No. 3, p. 222.

A child nine years of age suddenly lost the vision of the right eye. There were no prodromal symptoms and no

irritative signs or pain in the eye. The next day ophthalmoscopic examination revealed the characteristic picture of thrombosis of the central retinal artery. Paracentesis of the anterior chamber was performed immediately and systemic treatment with acetylcholine and "muthanol" instituted, but there was only insignificant improvement in the fundus in the next few days. General physical examination was negative. The Bordet-Wassermann reaction was negative. The Kahn and the Meinecke reactions were questionably positive. The father, however, had been treated some time previously for a syphilitic gumma, and on this basis the authors concluded that the lesion in the child was probably due to congenital syphilis. They stress the rarity of thrombosis of the central artery in children. Phillips Thygeson.

Paufique, L., and Bonamour, G. Prognosis of operations for senile retinal detachments. *Jour. d'Opht.*, 1944, v. 3, No. 3, p. 226.

The authors report statistics on 57 senile detachments. They define senile detachments as those occurring in the aged in the absence of marked refractive error, traumatism, tumor, secondary-membrane formation, or tuberculous or syphilitic lesions. About 30 per cent of detachments fell into this group. They showed no special clinical characteristics except frequent sclerotic changes in the retinal vessels. Of the 57 detachments, 46 were treated surgically, with success in 22. Of the 24 failures, 8 had initial reattachment followed by recurrence during the first three months of observation. Probable causes of failure included giant tears, massive postoperative vitreous hemorrhage, and multiple tears. In the 22 successes there were three

patients with a visual acuity between $2/3$ and 1, 13 with acuity between $1/4$ and $1/2$, and 6 with acuities between $1/10$ and $1/6$. The prognosis is definitely poorer for senile detachment than for other forms, and caution is recommended in advising operation in the aged who have one normal eye.

Phillips Thygeson.

Reca, A. B. Coats's exudative retinitis. *Anal. Argent. Oft.*, 1945, v. 6, Jan.-Feb.-March, pp. 1-5.

The condition is characterized by whitish masses at the posterior pole of the retina, occasionally including the disc, with or without vascular changes. Associated miliary aneurysms have been observed. The disease usually progresses with complications, detached retina, secondary cataract, iridocyclitis, and glaucoma. The latter occasionally necessitates enucleation. Tuberculosis, syphilis, and childhood diseases have been discussed as etiologic factors.

A 17-year-old girl is described, who, in the left eye, had typical massive exudative retinitis which was temporal to the disc and involved the macular area. All laboratory tests were negative. A differential diagnosis must exclude hereditary macular degeneration, disciform degeneration of the macula, retinitis circinata, tuberculous exudative retinitis, retinal degeneration with miliary aneurysms, tumors, and von Hippel's disease. (1 illustration.)

Edward Saskin.

Rodin, F. H. Hypertensive retinopathy associated with adrenal medullary tumor (pheochromocytoma). *Arch. Opth.*, 1945, v. 34, Nov.-Dec., pp. 402-407.

Pheochromocytoma is a rare form of chromaffin tumor, characterized by

a train of hypertensive symptoms, including definite ocular changes.

Epinephrine or an epinephrine-like pressor substance is contained in the cells of this tumor. Large amounts of this substance freed into the blood stream cause vasoconstriction, elevate blood pressure, and stimulate the sympathetic nervous system, producing paroxysms of hypertension. In the eye, changes are typical of hypertensive retinopathy.

Extensive changes in the retinas, characterized by changes in the retinal vessels, hemorrhages, and formation of exudate, were observed in a patient with an adrenal medullary tumor (pheochromocytoma). After removal of the tumor the ocular phenomena disappeared, as illustrated by serial photographs. There is no definite explanation of the mechanism by which the retinal changes are produced.

R. W. Danielson.

Vetter, J. Unilateral thrombosis of the central vein as a result of chronic chromate poisoning. *Klin. M. f. Augenh.* 1942, v. 108, Nov.-Dec., p. 720.

Chromic acid and its salts are poisonous. Workers in chromium-plating factories are constantly exposed to the fumes and dust of chromium compounds. Chronic rhinitis with destruction of the nasal mucous membrane and perforations of the nasal septum are the most characteristic result. Chronic bronchitis and bronchial carcinoma have been observed. Conjunctivitis and keratitis, and, less frequently, ulcers of the lids are seen. Fundus changes have been reported rarely. Vetter describes a man, 36 years of age, who had been employed in a chromium-plating factory for 16 years, who showed superficial and deep corneal opacities with regional vasculari-

zation in the left eye and a typical defect of the nasal septum. He had several recurrences in both eyes over a period of years. In January, 1942, the patient returned with a typical thrombosis of the left central retinal vein with central scotoma and some loss of vision. Rapid and almost complete recovery followed when the patient was removed from exposure to chromates. (Bibliography.) F. Nelson.

11

OPTIC NERVE AND TOXIC AMBLYOPIAS

Ostow, Mortimer. The significance of the depth of the physiologic cup of the optic disc for mental ability. *Jour. Nervous and Mental Disease*, 1945, v. 102, Dec., p. 571.

The author found a correlation between the depth of a physiologic excavation of the disc and intelligence. Four hundred and eighty persons, patients in mental hospital and non-psychotic prisoners, were examined. Among persons of high intelligence the greater number had a deep excavation of the disc, whereas flat discs predominated in individuals of low intelligence.

No relation was found to exist between disc cupping and the type of mental abnormality.

The author suggests that the physiologic excavation of the disc may be a manifestation either of an advanced stage of maturation of the structures of the central nervous system or of a superior type of physical growth. Superior intelligence might be another manifestation of the same process.

R. Grunfeld.

Tupin, M. A case of posthemorrhagic amblyopia. *Jour. d'Opht.*, 1944, v. 3, No. 3, p. 246.

A case of amblyopia in a man aged 37 years, suffering from hemorrhage secondary to a gastric ulcer, is reported. Vision $2\frac{1}{2}$ months after the hemorrhage was O.D. 5/10 in the right eye and perception of fingers at 10 cm. in the left. Ophthalmoscopic examination revealed optic atrophy, and the visual field of the better eye was limited to the central area plus a superior sector. The patient's general physical condition was good at the time. Post-hemorrhagic amblyopia is fairly common; reports of 250 cases have been reported up to 1935. In 87 percent of the reported cases the amblyopia was bilateral and the onset was most frequently between the third and sixteenth days; in about 40 percent of the reported cases some vision was recovered. Ischemia alone is insufficient to explain the pathogenesis of the amblyopia, since it occurs in only a small percentage of patients with severe hemorrhage. There is a widespread belief that some disturbance in the general health is necessary for the production of amblyopia. The subject of this report was a prisoner of war for $3\frac{1}{2}$ years and consequently suffered from a dietary deficiency.

Phillips Thygeson.

Yaskin, H. E., and Alpers, B. J. Foster Kennedy syndrome with post-traumatic arachnoiditis of optic chiasm and base of frontal lobes. *Arch. of Ophth.*, 1945, v. 34, Nov.-Dec., pp. 399-401.

The syndrome of atrophy of the optic nerve of one eye and papilledema in the other eye has come to be regarded as evidence of a tumor lying at the base of the frontal lobe. This relation was first pointed out by Paton (1909) and was further elaborated by Foster Kennedy (1911). Recent studies

have indicated that the syndrome may be found at times in association with arteriosclerosis of the internal carotid arteries, which compress the optic nerves and chiasm. The Foster Kennedy syndrome may thus be found in conjunction with disorders other than tumor and the conditions under which the syndrome may occur have been studied. Experience with a recent case indicates that it may develop also as a result of arachnoiditis in the region of the optic nerves and optic chiasm. This case is reported in detail.

R. W. Danielson.

13

EYEBALL AND ORBIT

Babel, Jean. A histologic study of ocular rheumatism. *Ophthalmologica*, 1942, v. 104, Nov., pp. 243-253.

Babel reports the clinical and pathologic findings in a case of a severe recurrent sclerotenonitis. He emphasizes the similarity between the histologic findings in the eye and in the other organs. The eye which he studied histologically was examined in a stage of regression of the primary disease, whereas the eyes previously described were all in the latest stage of the disease and were enucleated because of absolute glaucoma.

A man, 35 years of age, who had suffered from a recurrent rheumatic sclerotenonitis died of cardiac insufficiency. Pathologic studies of the right eyeball and the other organs is reported in detail. There was extensive dilatation of the veins and capillaries and a dense perivascular infiltration which consisted of lymphocytes, plasma cells, large, bright cells with basophile granules (similar to Aschoff's cells), and an occasional multinucleated giant cell. Those changes

were seen in the sclera, Tenon's capsule, the uvea, and the extraocular muscles. In the periorbital tissue there were similar aggregations of cells about the ciliary nerves. There also were typical rheumatic nodules in the extraocular muscles, where they formed a real rheumatic myositis. There was vascular sclerosis in the retina, and Tenon's space was obliterated. The optic nerve was normal despite the dense peribulbar infiltration. The cornea, lens, and vitreous were normal. Similar but less typical nodules were found in the myocardium, and in the synovial membranes. (References, 5 figures.)

Alice R. Deutsch.

Mattos, W. B. Palpebroconjunctival autoplasty. *Arquivos Brasileiros de Oft.*, 1945, v. 8, nos. 4 and 5, pp. 103-109.

The author briefly summarizes his own technique, as follows: He first incises horizontally the conjunctiva lining the cavity, parallel to the lid margins, from one canthus to the other. He then dissects back the conjunctiva to form two flaps, upper and lower. Three U-shaped sutures are passed in each conjunctival flap, coming out along the superior tarsal border in the skin of the lids. These are tied over a roll of gauze. In this way the loose conjunctiva will cover the posterior surface of both lids, leaving in the depth of the orbit a large area which is to be covered with the graft. Including all the layers of the skin, and of a size and form capable of covering all the denuded orbital area, a pedunculated flap is cut from the temporal region, the tissues are buttonholed a little outside and below the external canthus, at the orbital margin, and the flap is introduced through the button-

hole, its tip being tied at the caruncle to maintain proper position. The skin is sutured in the temporal region. The angles formed by the grafted skin and by the conjunctiva transplanted under the lids form the upper and lower cul-de-sacs. After six days all the sutures are removed, and the transplanted skin within the buttonhole is strongly curetted to avoid formation of a fistula as the result of nonresection of the pedicle. (8 illustrations, 4 in color.)

W. H. Crisp.

14

EYELIDS AND LACRIMAL APPARATUS

Balod, K. An improvised dacryocystorhinostomy needle. *Klin. M. f. Augenh.*, 1942, v. 108, Sept.-Oct., p. 626.

Since it is not always possible to obtain special instruments during war time, Balod improvised a needle for dacryocystorhinostomy by bending the tip of a hypodermic needle to form a hook of desired size and angle after heating it in an alcohol flame. To obtain a suitable eye, the hook was filed transversely near the tip until a hole of sufficient size was obtained to admit the suture. The finished needle was attached to an ordinary syringe that served as a handle. (1 illustration.)

F. Nelson.

Cutler, N. L. Surgery for upper-lid atrophy. *Amer. Jour. Ophth.*, 1946, v. 29, Feb., pp. 176-179. (7 figures, references.)

Hall, Arthur. The origin and purposes of blinking. *Brit. Jour. Ophth.*, 1945, v. 29, Sept., pp. 445-467.

The work reported is the result of an inquiry undertaken to find out to what extent the rate of blinking is reduced in the patient with chronic encephalitis.

The average rate of blinks per minute by patients with chronic encephalitis when in conversation was less than half that of normal subjects; yet when reading aloud, the rate of blinking was practically the same in the two groups.

Most of the blinking which occurs in daily life is in no way connected with the efficient action or protection of the eyes themselves but plays a part in the preservation of the organism as a whole. It is so brief that it does not interfere with vision and one is not aware of its occurrence. It varies in frequency and purpose.

A review of blinking in other vertebrates, which is indistinguishable from that in man, is given. Two involuntary unconditioned reflexes are inherited by all animals. These reflexes are opposed and cannot be in action at the same time. There are two distinct and opposed cortical ocular reflexes: one is excited by extramacular stimuli and effects movements of the eyes; the other is of macular origin and holds an object in central fixation. The extramacular reflex is more primitive in origin and of vital importance in self-preservation. The rate of blinking is much higher in the herbivora than in the carnivora. The fact that the blinking rate is higher in the "hunted" animal than in the "hunting" animal suggests that its purpose is connected with the self-preservation reflex.

Blinking in the arboreal primates is much higher than that in the lower animals, presumably due to interest in their surroundings, yet the primitive blinking of the self-preservation reflex in association with the other sense organs still remains exactly as in the lower animals.

In man, the rate of blinking is similar to that in the arboreal primates. The fixation-reflex constantly changing

in direction is essential, but the extramacular reflex for purposes of self-preservation is still present in its primitive form, and at any moment, when danger threatens, fixation is shut off by a blink and the eyes assume control of the body's activities in coöperation with the other sense organs.

Even in the congenitally blind in whom the act of fixation has never taken place, the eyelids blink when a threatening sound occurs. (6 figures, references.) Edna M. Reynolds.

Llanos, N. G. Dacryocystorhinotomy. *Rev. Oto-Neuro-Oft.*, 1945, v. 20, June-July, pp. 69-70.

Various procedures are discussed. The author favors that of Donato Valle, which he does not describe. He dislikes the hammer and chisel method of trepanning the maxilla and ethmoid. In suturing the mucosa of the sac to that of the nose he uses 000 catgut on Dechamps needles. Edward Saskin.

Pereira, R. F., and Tolosa, E. C. Dacryosinusitis simulating dacryocanalculitis. *La Semana Méd.*, 1945, v. 52, Dec. 6, pp. 893-896.

A man aged 40 years had chronic suppuration of the conjunctival cavity of the right eye, arising from the upper lacrimal canaliculus. Catheterization of the canaliculus demonstrated, under radiographic control, the existence of a dacryoethmoidal fistula, and rhinologic examination revealed a sinusitis of the ethmoids and of the maxillary of the right side. Surgical treatment of these conditions resulted in complete disappearance of the suppuration and spontaneous closure of the fistula. (References.) W. H. Crisp.

Vaccaro, H., Cabezas, J., and Jorquera, E. Lysozyme as a defense factor

in ophthalmology. Arch. Chilenos de Oft., 1945, v. 1, March-April, pp. 3-24.

The authors state the results of what they call the Sarcina test (using *Micrococcus lysodeikticus*, supplied by the Mead Johnson laboratories). The conditions of the test are described. The normal tears provoked total lysis even in dilutions of 1 to 2,000, with 24 hours contact at 37 degrees. Greater dilutions produced partial action, there being traces of lysis even in dilutions of 1 to one million. For shorter periods of incubation, greater concentrations were required. The lysozyme content in pathologic secretions varied with the period of evolution of the disease, the proportion being increased in the earlier days of the disease for any type of ocular inflammation. The highest titer of lysozyme was experienced in those ocular affections in which bacteriologic examination was negative. (4 figures, 7 tables, 3 graphs, bibliography.)

W. H. Crisp.

15

TUMORS

Love, J. G., and Benedict, W. L. Intraorbital tumors. Jour. Amer. Med. Assoc., 1945, v. 129, Nov. 17, p. 777.

Since the transcranial approach to tumors of the posterior orbit gives maximal exposure and direct visualization of the structures involved, and since at the same time it permits removal of an intracranial extension of the tumor, the authors feel that this is the procedure of choice. A neurosurgeon should be chosen for the surgical treatment of such retrobulbar orbital tumors. The diagnosis and treatment of posterior orbital tumors in patients aged two months to 53 years are described. Symptoms were varied, although proptosis was by far

the most common. Meningioma was the most common tumor. Thirteen tumors had extended beyond the orbit. All patients recovered but one, an infant who died of hyperthermia.

Morris Kaplan.

Offret, G. Primary epithelial tumors of the ciliary region. Arch. d'Opht., 1945, v. 5, No. 2, p. 11.

In an extensive monograph, Offret reviews the subject of epithelial tumors of the ciliary body. He describes simple primary epithelioma as the least frequent neoplasm of the ciliary body. It develops in eyes which have suffered from traumatism or infection, particularly in elderly individuals, and is characterized by its large size, by pigmentation, degenerative changes, slow growth, association with cysts of the iris and ciliary body, and usually by the absence of metastases.

A second, more frequent primary malignant tumor, often called diktyoma and found in children from two to eight years of age, is described as "type retine." Nonpigmented, quite flat, and accompanied by increased intraocular pressure, this tumor is often mistaken for a retinoblastoma. Histologically it is made up of interlacing ribbons or membranes of one to many layers of cells, often with glandular tube formation. Rosettes are occasionally seen. There is an inconspicuous connective-tissue stroma. Hemorrhage into the tumor and areas of necrosis are frequent. Extension is limited, although perforation of the globe has occurred. The malignancy is more histologic than clinical.

The benign ciliary epithelial tumors are common; in 1932 Wolff made 58 observations. Characteristically they produce no clinical symptoms, are small in size, and demonstrable only on

microscopic examination of enucleated eyes. With few exceptions they are encountered only in individuals over 50 years of age. Histologically, these tumors are destructive because the epithelium has no connective-tissue supporting structure and no distinct vascular supply. Offret strongly opposes Fuchs's classification of these benign epithelial tumors as inflammatory and senile epithelial excrescences of the ciliary body.

Phillips Thygeson.

Paufique, L., and Chavanne, H. Glioma of the chiasm. *Jour. d'Opht.*, 1944, v. 3, No. 3, p. 229.

A new case of glioma of the chiasm is reported. The patient, a man 22 years old, first developed muscular asthenia, loss of appetite, apathy, and loss of weight, in March, 1942, followed by signs of diabetes insipidus. In August, 1943, difficulty in reading developed and rapid loss of vision until there was light perception only. At this time he showed marked loss of weight, hypothermia, and loss of secondary sexual characteristics. There were no motor nor sensory neurologic findings other than the optic-nerve disturbance. X-ray studies of the skull were normal. Operation, performed in October, 1943, revealed a basal arachnoiditis. There was marked increase in the volume of the right optic nerve and chiasm. On puncture, viscous fluid was obtained from the chiasm, comparable to that found in glioma. Post-mortem examination revealed a neoplasm invading the entire region of the third ventricle. The chiasm was cystic, increased in volume. Diagnosis: glioma, histologically confirmed. A discussion of the signs and symptoms of tumors with chiasmal findings is presented.

Phillips Thygeson.

16

INJURIES

Curtis, G. H. Contact dermatitis of eyelids caused by antioxidant in rubber fillers of eyelash curlers. *Arch. Dermat. and Syph.*, 1945, v. 52, Oct., p. 262.

Seven cases of contact dermatitis due to sensitivity to the rubber filler of eyelash curlers were observed. In five cases the allergen was found to be phenyl-beta-naphthylamine, an antioxidant used in the manufacture of rubber fillers. In addition to the history of contact and positive reactions to patch tests, the dermatitis may be distinguished from other common dermatoses of the eyelids as well as from eczematous contact dermatitis due to other allergens by the facts that (1) the dermatitis is subacute rather than acute and vesicular; (2) it tends to occur in linear bands; (3) if it involves the whole of the upper lid there is a narrow band of normal skin along the tarsal fold and between the dermatitis and the margin of the lid, and (4) the eyelashes show artificial curling.

Theodore M. Shapira.

Obal, A. Comparison of the healing of perforating eye injuries before and after the introduction of milk injections (computation of the years 1907-1908 and 1937-1940). *Klin. M. f. Augenh.*, 142, v. 108, Sept.-Oct., p. 614.

In the years 1907 to 1909, 190 patients had been treated in the University Eye Hospital in Vienna for perforating eye injuries. One half of the eyes with lens injuries and 15.8 percent of those without lens injuries were lost. In the years 1937 to 1940—that is, after the introduction of parenteral milk injection—201 patients were treated. Only 31.8 percent of the eyes

with lens injury and 9.1 percent of those without lens injury were lost. One must remember, however, that in the latter period patients with intraocular infection were given not only milk injections, but also typhoid vaccine and sulfa drugs. (References.)

F. Nelson.

Struble, G. C., and Croll, L. J. **Removal of magnetic foreign bodies.** *Amer. Jour. Ophth.*, 1946, v. 29, Feb., pp. 151-161. (15 figures, references.)

17

SYSTEMIC DISEASES AND PARASITES

Mendonça de Barros, J. **Treatment of ocular syphilis.** *Arquivos Brasileiros de Oft.*, 1945, v. 8, nos. 4 and 5, pp. 110-125; also *Rev. Brasileira de Oft.*, 1945, v. 4, Dec., pp. 91-110.

This is a 16-page review of the whole subject, with emphasis upon the principle that the syphilitic patient should have thorough treatment for his general condition, and not merely for the ocular manifestations. W. H. Crisp.

Pacheco Luna, R. **Guatemalan onchocercosis.** *Rev. Oto-Neuro-Oft.*, 1945, v. 20, Jan.-Feb., pp. 13-17.

An academic discussion of the disease is presented, including history, parasitology, and general symptoms. There are characteristic ocular symptoms which are grave, and may be followed by blindness. Photophobia, blepharospasm, and foreign-body sensation are due to a chronic keratitis, plastic uveitis, and filariae in the vitreous. The condition may terminate in phthisis bulbi and hypotension. Actual intraocular tumefaction also occurs; sometimes the tumors can be extirpated, but the disease progresses unfavorably. Treatment is unsatisfactory.

Edward Saskin.

18

HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Graff, Th. **War restrictions in ophthalmologic optics.** *Klin. M. f. Augenh.*, 1942, v. 108, Nov.-Dec., p. 745.

Graff discusses the restrictions and regulations necessitated by the war. The manufacturing of biconcave and biconvex spheric and cylindric lenses as well as plano-convex, plano-concave, and periscopic lenses is forbidden. Only two types of bifocal lenses are allowed. The difference between distance and near parts must not be smaller than one diopter. When the total refractive error is greater than five diopters, lenses may be prescribed only in differences of one-half diopter; when it is greater than 10 diopters, difference must be one diopter. In cylindric lenses one-half-diopter differences are allowed. Tinted, ground lenses may be manufactured only to allow 50-percent or 75-percent absorption in the visible spectrum and total absorption of the ultraviolet rays. Clampover glasses are not permitted. Gradually ophthalmologic instruments will be strictly standardized. The author hopes that such restrictions will be perpetuated in the postwar period.

F. Nelson.

Howe, P. J., and Osterman, M. R. **Medical social service with glaucoma patients.** *Sight-Saving Rev.*, 1945, v. 15, Summer, p. 80.

The social worker must give glaucoma patients more than financial relief. Such patients particularly need the relief from anxiety and fear which come from a free discussion with his social worker, as well as help in carrying out his part of the treatment. This

service is needed as much by private patients as by clinic patients.

R. Grunfeld.

Koch, F. L. P., and Smith, V. M. *Glaucoma clinic procedures*. *Sight-Saving Rev.*, 1945, v. 15, Summer, p. 92.

The procedure in use at the demonstration glaucoma clinic is described in detail.

R. Grunfeld.

Law, F. W. *Some public health aspects of ophthalmology*. *Sight-Saving Rev.*, 1945, v. 15, Spring, p. 13.

In this address the author ranges over the whole field of ophthalmology. In the early history of ophthalmology in England most of the practitioners were unqualified though they achieved places of eminence in the courts. The tremendous strides made in industrial ophthalmology are discussed. Improvements in industrial and domestic lighting are described. The problem of the relation of the ophthalmologist to the optometrist and its projected solution in England are discussed. Since there are not enough ophthalmologists to accomplish all the work of refraction it is suggested that the hospitals employ properly trained, medically supervised opticians. After describing and praising orthoptic exercises the author denounces as pure charlatanism the practice of eye exercises to improve vision or to cure cataracts.

Morris Kaplan.

Minton, Joseph. *The one-eyed worker*. *Brit. Jour. Ophth.*, 1945, v. 29, Sept., pp. 472-476.

Investigations of the employment of one-eyed workers in industry, made in 1938, are reported.

Persons who have lost an eye in

childhood are in no way handicapped and have full confidence in the carrying out of their work. One finds men of this group employed in the building trades, in the engineering trades, and in the tool-making industry. They suffer few disadvantages in the labor market.

An investigation of 100 men and women who had lost an eye in adult life showed that the greatest number of injuries occurred in the mining, metal, and engineering industries, in such processes as hammering, chipping, boring, or milling.

After the excision of an eye, the patient must adjust to new visual conditions. The length of time required varies from a few weeks to several months. Women are slow to adjust, and their depth perception may long remain inaccurate. The loss of the dominant eye produces greater disability and delays adjustment to monocular vision. An instrument for determining whether the one-eyed person is left with the dominant eye is described.

The period of enforced absence from work should not exceed two or three months, but many men do not return to work for six to nine months.

Detailed accident statistics kept by safety departments indicate that there is no evidence to show that one-eyed persons are more prone to accidents than the normal-sighted.

Occupations considered suitable for one-eyed people are listed by the author. If the vision of the remaining eye is 6/6 or 6/9, the one-eyed patient can follow comfortably all occupations involving close work, except operations in the metal and engineering trades, which may cause injury to the remaining eye. If the vision is 6/12, constant close work is not recommended, but employment in the food

and distributive trades or in the building trades is advised. One-eyed drivers with 6/12 vision are considered safe. If the vision is less than 6/12, gardening, farming, and domestic service are the most suitable occupations.

The danger of injury to the remaining eye should always be considered when men wish to return to work in the engineering and metal trades. Miners should not be reemployed in underground work. Most one-eyed men and women are fit for most jobs, but the safety of the remaining eye must be the first consideration.

Edna M. Reynolds.

Minton, Joseph. Vision and the selection of personnel in industry. *Sight-Saving Rev.*, 1945, v. 15, Summer, p. 67.

All occupations may be classified in five groups on the basis of visual requirements. The occupations in group 1—the manufacture of silk yarns, silk hose, electric-light bulbs, and watches, for example—require very good eyesight (6/6 in one eye, 6/36 in the other eye). Those in group 2—all clerical work, engineering, and the driving of vehicles—need good eyesight (6/12 and 6/36). All industrial occupations except those in which depth perception is necessary form group 3. Only fair vision is needed (6/12 and 6/36 or one blind eye). Workers in group 4, those in outdoor occupations such as building trades, carpentry, dock labor, and portering may have weak eyesight (6/24 and 6/36). Group 5 contains a great number of industrial and other occupations which are suitable for the blind and the partially blind. A list of these occupations has been prepared by the National Society for the Prevention of Blindness. R. Grunfeld.

Polack, M. Tscherning and his work. *Ann. d'Ocul.*, 1940, v. 177, no. 5, pp. 179-187.

Marius Hans Erik Tscherning was born in 1854, in Denmark, where he spent most of his life. His 75 contributions to ophthalmology, including his exemplary textbook on physiologic optics, are a lasting monument to a truly great man. He was admitted to the degree of Doctor of Medicine in 1887, in Paris, and remained there until 1910, when he became professor of ophthalmology in the University of Copenhagen. He retired from teaching in 1925, but continued his investigations until his death in 1939. Chas. A. Bahn.

Sorsby, Arnold. The incidence and causes of blindness in the British Commonwealth. *Brit. Med. Jour.*, 1945, Oct., 27, p. 557.

The number of blind persons in the British Isles is between 90,000 and 100,000. In the Dominions, between 40,000 and 50,000 white persons and about 10 millions natives are blind. There has been a marked decline in the incidence of blindness in childhood and early youth and an increase in later life. Further decline in the incidence of blindness in youth will soon come to an end. Even now about 65 percent of blindness in youth is caused by congenital factors. Reduction in the incidence of blindness in the future can be achieved only by intensive research in the problems of congenital diseases, maternally transmitted infections, cataract, glaucoma, and the diseases of the aged. In the native population of the British possessions, the incidence of blindness could be reduced immediately and effectively by an intensified and organized effort to treat

the widely prevalent ocular infection with sulfa drugs and penicillin.

R. Grunfeld.

19

ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Stone, L. S. Heteroplastic lens grafts related to factors inhibiting lens regeneration in *Triturus*. Proc. Soc. Exper. Biol. and Med., 1945, v. 60, Oct., p. 10.

The presumptive lens-forming ectoderm over the optic vesicle of embryos in the early tail-bud stage was exchanged between *Amblystoma punctatum* and *Triturus torosus*. Normal lenses developed. Some of them were observed for 98 days. When the lenses of the two species were exchanged between larvae about 17 mm. in length, the exchanged lenses survived and grew well for a long time. If the heteroplastic lenses were excised 70 days after the exchange, regeneration of the lens tissue took place in the *triturus*

eye from the dorsal rim of the iris, as it normally occurs following lensectomy. In the *amblystoma* eye, however, no such regeneration of the iris tissue takes place since under normal condition no regeneration of the iris tissue occurs after lensectomy.

Lenses of young adult *amblystoma* eyes were implanted in lensectomized eyes of adult *Triturus viridescence*. If the lenses survived they became endowed with the capacity to inhibit new formation of lens from the dorsal rim of the iris, but if the lens became cataractous the inhibitory effect diminished.

If lenses from the tadpole eye were implanted, or if wax spheres of the same size as normal lenses were placed in lensectomized eyes of the *triturus*, no inhibitory effect was exercised, and a new lens developed from the dorsal rim of the iris, proving that mechanical factors are not responsible for the inhibition.

R. Grunfeld.

PAN-AMERICAN NOTES

Edited by DR. M. URIBE TRONCOSO
500 West End Avenue, New York 24

Communications should reach the editor by the twelfth of the month.

THE SECOND PAN-AMERICAN OPHTHALMOLOGICAL CONGRESS

This Congress was held at Montevideo, Uruguay, from November 26 to December 1, 1945. It was a decided success from the standpoint of attendance. Although the United States ophthalmologists were few in number, owing to the great difficulties in transportation, some representative members were present. Among them we must mention Captain Clifford A. Swanson, representing the Navy; Commander Walter P. Griffy, representing the Public Health Service; Dr. Ramón Castroviejo, representing the American Ophthalmological Society; Dr. Conrad Berens, representing the American College of Surgeons; Dr. Thomas D. Allen of Chicago, and Dr. Joseph I. Pascal of New York. Latin-American countries were, on the other hand, very well represented. Brazil had the largest number, with 123 members present; Chile had 16; Cuba, 19; Mexico, 3; Bolivia, 3; Ecuador, 1; Guatemala, 1; Colombia, 2; Costa Rica, 2; Paraguay, 5; Peru, 7; Dominican Republic, 1; Venezuela, 3. Uruguay, where the Congress was held, had a representation of 70 members. The Argentinian ophthalmologists did not attend the Congress officially. Even members of the Board of Directors of the Congress withdrew, because of the political conditions through which Argentina is passing. The Asociación Médica Argentina decided earlier in November, 1945, to stop all scientific activities of its members as a civil protest against the state of constitutional abnormality, which, unfortunately, has existed in that country for some time. The Argentine Ophthalmological Society,

which is a part of the Medical Association, decided to find out by a plebiscite if its 80 members could attend the Congress at Montevideo as an exception to the general rule. The plebiscite had 70 members in favor of cessation of all scientific activities against 5 in opposition. The Society then addressed an official communication to the Board of Directors of the Congress, informing them of the withdrawal of Argentine members.

Dr. Vazquez Barriere, president of the Board, opened the meeting by stressing the necessity of inter-American coöperation for the advancement of ophthalmology and the prevention of blindness. Dr. Harry S. Gradle, president of the Congress, could not attend the meeting because of illness. His address was read by Professor Alvaro of Brazil, and his recommendation to form a Board of Ophthalmology for Latin-America was later acted upon and accepted.

The meetings were held according to the program previously published in this column and were quite successful and well attended, although the meeting place was a hotel somewhat distant from the city of Montevideo. The inaugural session was attended by the municipal and university authorities and members of the Diplomatic Corps. Dr. Arruga arrived from Spain after a difficult and delayed trip. His discussion of the treatment of detachment of the retina was a valuable contribution to our knowledge of the subject.

The Congress decided to change its name to "Pan-American Association of Ophthalmology." The following officers of the new association were elected at the

Montevideo meeting: president, Dr. Harry S. Gradle; honorary president, Professor Alberto Vazquez Barriere; vice-presidents: Dr. Francisco Belgeri (Argentina), Dr. Frank Brawley (U. S. A.), Dr. J. Pereira Gomes (Brazil), Dr. Frederick C. Cordes (U.S.A.), Dr. J. A. MacMillan (Canada), Dr. Alex Aguero (Costa Rica); Dr. G. Espildora Luque (Chile), Dr. R. Pacheco Luna (Guatemala), Dr. A. Torres Estrada (Mexico); executive secretaries: Professor Moacyr E. Alvaro (Brazil) and Dr. Conrad Berens (New York).

The Committee on Ophthalmological Education appointed a president, Dr. Jorge Valdeavellano (Lima, Peru), and three secretaries whose work will be divided as follows: Dr. Thomas D. Allen in charge of Canada and the United States; Dr. Miguel Branly (Cuba) in charge of Mexico, the continental countries of Central America, the islands of the Caribbean, Venezuela, and Colombia; and Dr. Paul Rodriguez Barrios (Montevideo, Uruguay) in charge of Ecuador, Peru, Bolivia, Chile, Argentina, Paraguay, Uruguay, and Brazil.

The Committee on Kellogg Fellowships appointed Dr. Harry S. Gradle, Dr. Conrad Berens, Dr. Tomas Yañes, and Prof. Moacyr E. Alvaro to represent the Association.

A committee was appointed to draw up a constitution and by-laws for the new Association. This consists of Dr. Tomas Yañes, Dr. Conrad Berens, and Professor Alberto Vazquez Barriere.

The next meeting of the Pan-American Association of Ophthalmology is planned for February, 1948, in Havana, Cuba. All ophthalmologists in the Western Hemisphere will be invited to become members of the Association. Membership entitles receiving the official publication "Ophthalmologia Ibero Americana," which has been in existence for several years and is printed in three languages: English, Spanish, and Portuguese.

Communications concerning the Association should be addressed to Prof. Moacyr E. Alvaro (1151 Rua Consolação, São Paulo, Brazil) if mailed south of Panama, and to Dr. Conrad Berens (301 East 14th Street, New York 3, N.Y.) if mailed north of Panama.

NEWS ITEMS

Edited by DR. DONALD J. LYLE

904 Carew Tower, Cincinnati 2

News items should reach the editor by the twelfth of the month.

DEATHS

Dr. Wylie M. Ayres, Cincinnati, Ohio, died December 22, 1945, aged 71 years.

Dr. Frederick Brown, Valley City, North Dakota, died November 13, 1945, aged 65 years.

Dr. William C. Comee, Green Bay, Wisconsin, died December 8, 1945, aged 59 years.

Dr. John F. Curtin, Minneapolis, Minnesota, died December 25, 1945, aged 56 years.

Dr. Clarence P. Franklin, Philadelphia, Pennsylvania, died December 11, 1945, aged 75 years.

Dr. Lee M. Goodman, Jersey Shore, Pennsylvania, died recently, aged 64 years.

Dr. Edgar S. Harris, Independence, Missouri, died November 27, 1945, aged 68 years.

Dr. Isaiah W. Haughey, Fort Collins, Colorado, died December 5, 1945, aged 77 years.

Dr. Max L. Holland, Roanoke, Virginia, died November 9, 1945, aged 37 years.

Dr. Howard E. Jones, Circleville, Ohio, died December 12, 1945, aged 92 years.

Dr. Charles F. Jump, Helena, Montana, died October 23, 1945, aged 63 years.

Dr. William G. Kennon, Nashville, Tennessee, died January 3, 1946, aged 62 years.

Dr. John F. Klinedinst, York, Pennsylvania, died December 6, 1945, aged 78 years.

Dr. Emory L. Kniskern, Muskegon, Michigan, died January 26, 1946, aged 77 years.

Dr. Charles E. Lauder, Viroqua, Wisconsin, died December 6, 1945, aged 79 years.

Dr. David L. Martin, Boston, Massachusetts, died December 6, 1945, aged 71 years.

Dr. John H. F. O'Neil, Chicago, Illinois, died December 20, 1945, aged 61 years.

Dr. William H. Phillips, Cleveland, Ohio, died December 19, 1945, aged 74 years.

Dr. Frank D. Smith, Rochester, Minnesota, died December 8, 1945, aged 64 years.

Dr. Henry M. Smith, Brooklyn, New York, died February 23, 1946, aged 75 years.

Dr. Lee W. Smith, Butte, Montana, died November 18, 1945, aged 53 years.

Dr. Thomas M. Stewart, Cincinnati, Ohio, died December 10, 1945, aged 79 years.

Dr. William G. Stinchcomb, Bellefontaine, Ohio, died December 19, 1945.

Dr. John P. Young, Chester, South Carolina, died November 29, 1945, aged 75 years.

MISCELLANEOUS

FIRST PAN-AMERICAN CONGRESS OF OTOLARYNGOLOGY AND BRONCHO-ESOPHAGOGY. Immediately following and overlapping with the

annual meeting of the Academy in October of this year, the First Pan-American Congress of Oto-Rhino-Laryngology and Broncho-Esophagology will take place, under the sponsorship of the Academy. This Congress will open with a banquet and evening session on Thursday night, October 17th, and will continue on the two subsequent days. The first scientific session will be a joint session with the Otolaryngology Section of the Academy, and three additional sessions will take place on Friday afternoon, Saturday morning, and Saturday afternoon. All interested members of the Academy are strongly urged to plan to remain for the Pan-American Congress, for which an excellent program is being arranged.

The registration fee will be \$5.00.

Executive committee, Pan-American Congress: Gordon B. New, M.D., president; Chevalier L. Jackson, M.D., secretary; Paul H. Holinger, M.D., treasurer.

The Oregon Academy of Ophthalmology and Otolaryngology held its seventh annual Spring postgraduate convention in ophthalmology and otolaryngology from April 15th to April 20th. The guest speakers were Dr. Gabriel Tucker of the University of Pennsylvania Graduate School and Dr. Peter Kronfeld of the Illinois Eye and Ear Infirmary, University of Illinois. Dr. Kenneth C. Swan of the University of Oregon Medical School gave a course on ocular histopathology. Included in the program were lectures on endaural surgery, clinical demonstrations of problem eye cases, intranasal operations, the measurement of astigmatism, brain abscesses, Lempert operation, and cadaver demonstrations.

The International College of Surgeons, United States Chapter, will hold its eleventh annual assembly and convocation in Detroit, Monday, Tuesday, Wednesday, October 21-22-23, 1946.

Surgical clinics in Detroit hospitals will feature the first morning of the Assembly. Thereafter all the meetings, the convocation, and the exhibition will be held in the Masonic Temple, a splendid building affording every convenience.

Copy of the program and detailed information may be obtained by writing Dr. Louis J. Garipey at 16401 Grand River Avenue, Detroit.

SOCIETIES

The fifteenth scientific meeting of the Association for Research in Ophthalmology will

be held in San Francisco, at the Hotel Mark Hopkins on Tuesday, July 2, 1946.

The fifty-second meeting of the Reading Eye, Ear, Nose and Throat Society was held on February 20, 1946, as a joint meeting with the Diplomates' Association of Berks County Physicians. The speaker of the evening was Dr. Harry Rogers, president, American College of Allergy. His talk was a review of the allergies as they apply to the specialties.

At the meeting of the Milwaukee Otolaryngic Society, held on March 26th, Dr. Samuel M. Feinberg, Northwestern University, Cook County Hospital, presented a paper on "Allergy of the eye, ear, nose, and throat: Practical evaluation and management of cases." The discussion was opened by Dr. Theodore L. Squier with Dr. F. Herbert Haessler giving the eye physician's viewpoints and Dr. Frank G. Treskow giving those of the ear, nose, and throat physician.

The Brooklyn Ophthalmological Society held its ninety-sixth regular meeting on April 18th. The scientific program consisted of the following presentations: "Ocular manifestations of skin diseases" by Dr. Nathan Sobel; and "Surgical management of squint" by Dr. Harold W. Brown.

At the annual meeting of the Pennsylvania Academy of Ophthalmology and Otolaryngology on April 24th-25th, the following program was presented: "Some interesting phases of war ophthalmology," by Dr. James N. Greear, Jr.; "Pan-American otolaryngology," by Dr. Chevalier L. Jackson; "Anesthesia in ophthal-

mology," by Dr. Walter S. Atkinson; "Retinal arteriolar sclerosis," by Dr. Walter I. Lillie; "Contemporary medical problems," by Dr. Robin C. Buerki; and "Symposium on the hard of hearing," by Captain Fred Harbert.

PERSONALS

Dr. George M. Haik, New Orleans, has been appointed professor of ophthalmology at the Louisiana State University Medical School, New Orleans, succeeding the late Dr. Theodore J. Dimitry.

Major Frederic T. Becker (MC) of Memphis, spoke on "Cutaneous eruptions frequently seen in eye, ear, nose, and throat practice," at the 1946 session of the Medical Association of the State of Alabama.

Dr. Wiley R. Buffington spoke on "Detached retina" at the seventieth session of the Arkansas Medical Society, April 15th-17th.

Dr. Alan C. Woods presented a paper, entitled "Early treatment of eye injuries," before the Medical and Chirurgical Faculty of Maryland at its meeting on April 23d-24th at the Belvidere Hotel, Baltimore.

Dr. James W. White of New York was among the guest speakers at the ninth annual meeting of the New Orleans Graduate Medical Assembly.

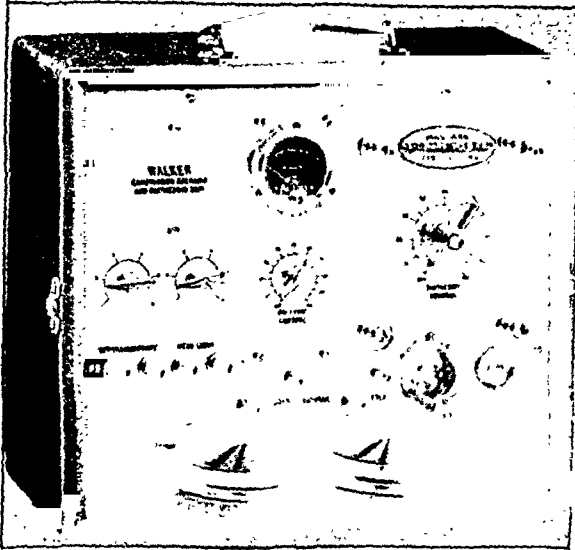
Dr. Arthur M. Culler was among the participants in the program given by the faculty members of the Ohio State University College of Medicine on March 27th. He discussed "Progress in ophthalmologic practice and research."

Storz

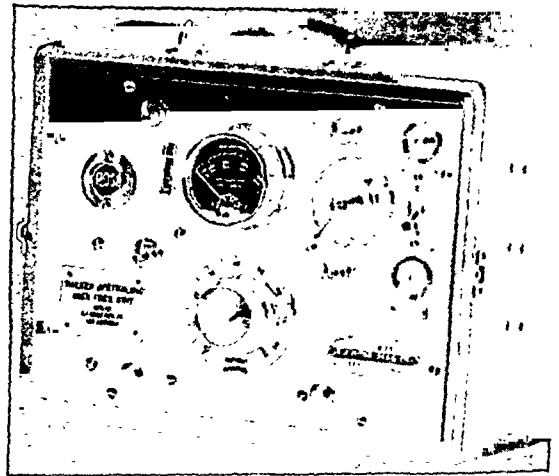
WALKER OPHTHALMIC COMBINATION UNIT

For Use in Retinal Detachment Operations

WALKER OPHTHALMIC HIGH FREQUENCY UNIT



52



51

This newer model features the use of galvanic current in conjunction with high frequency current. The milliamperage meter is omitted, but a galvanic milliamperage meter is supplied. A double foot switch operates the selection of cathodal galvanic, anodal galvanic, or high frequency current. Either section may be operated independently. It has terminals for attaching the ophthalmoscope and the headlight. Galvanic current supply is from two 2½-volt dry cells, standard size, replaceable from any radio stock. This battery should have a life of from ten to twelve months.

Weight 25 pounds. The carrying case 14½" x 12½" x 10". Receptacle in the bottom for foot switch, line cord, etc. For 110 volt, 50 or 60 cycle A. C.

Accessories for No. 52:

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With portable case 10½" x 14½" x 8". For 110 volt 50 or 60 cycle A. C.

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INCIPIENT PANNUS AS A SIGN OF THE PRIMARY CORNEAL
INFECTION OF TRACHOMA AND AS AN IMPORTANT
CRITERION FOR THE EARLY DIAGNOSIS
OF THE DISEASE*

P. K. Kuo, M.D.

Chungking, China

INTRODUCTION

Difficulties in differentiating trachomatous from nontrachomatous conditions, especially in so-called "borderline" cases, are encountered by every ophthalmologist. In fact, the striking similarity between certain forms of chronic conjunctivitis and trachoma I (McCallan) may make a strict differentiation between the two almost impossible, even to the most experienced. Too often ophthalmologists have to be content with a temporary diagnosis of suspected trachoma, settling upon the exact nature only after subsequent observations.

Although certain clinical peculiarities of trachoma—such as, the peculiar haziness of the lower cul-de-sac as a result of the diffuse subconjunctival infiltration; the typical localization of the papillary hypertrophy and follicular formation, chiefly on the upper tarsal conjunctiva and fornix conjunctivae; the large and irregular sizes of the follicles, which tend to become confluent; the diffuse, hazy appearance over the follicular surfaces as well as over the parts in between; and the presence of Prowazek-Halberstaedter's inclusion bodies or Lindner's initial bodies in the conjunctival smear—may be

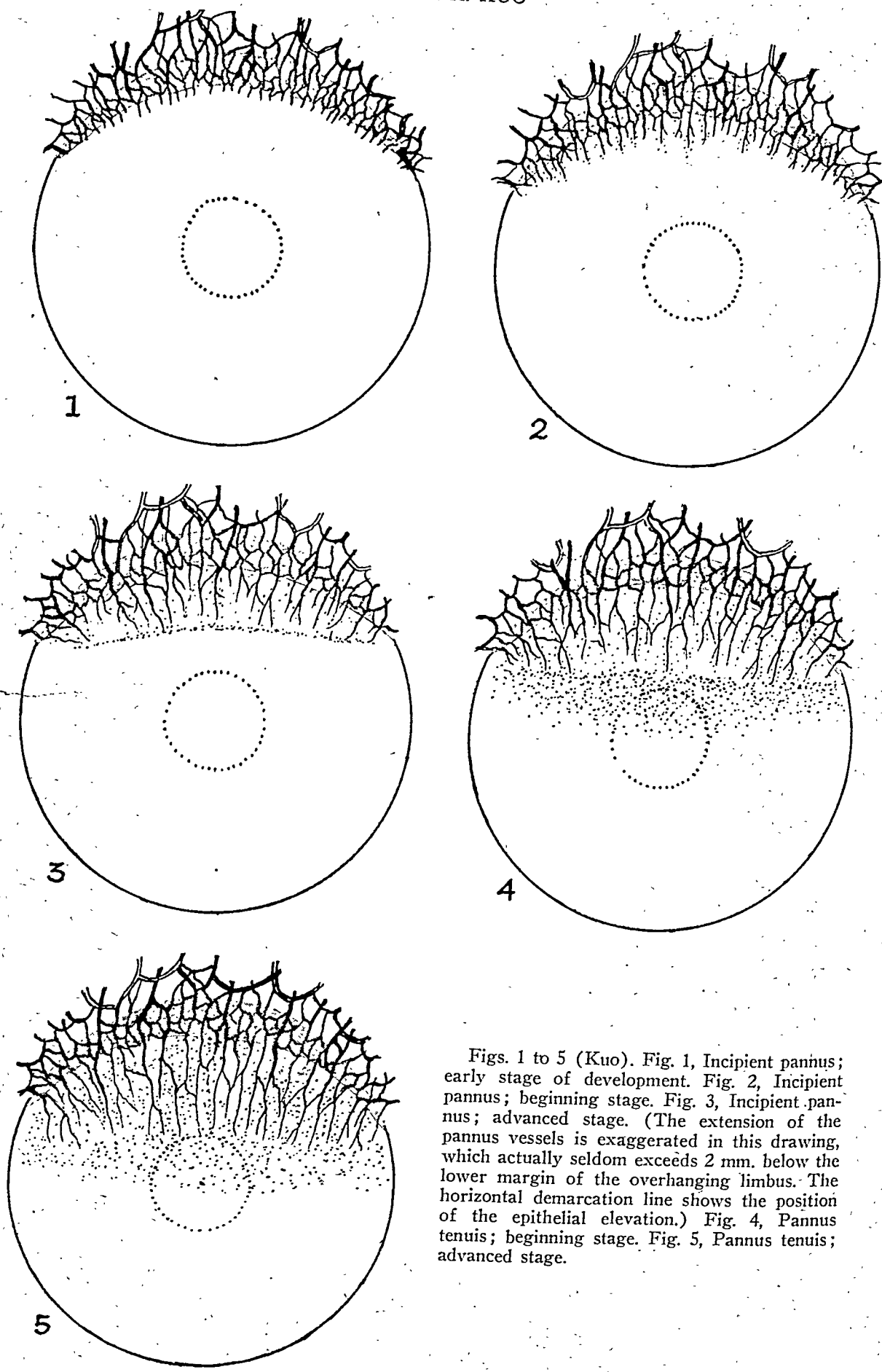
regarded as more or less characteristic of trachoma, cases are not infrequently encountered wherein, if these characteristics are only poorly presented clinically, decisive final diagnosis may become impossible.

When, as in the case of mass physical examination, large crowds are expecting prompt diagnosis, the long search for the inclusion bodies is almost impracticable. Moreover, the inclusion bodies, typical as they are for trachoma, are also demonstrable in the so-called paratrachoma cases of Lindner as well as in cases of "swimming-bath" conjunctivitis, and the failure to find the inclusions cannot be taken as evidence against the positive diagnosis of the disease.

In the course of eight years, I have been searching for some additional characteristics of trachoma in its early stage (trachoma I, McCallan) that will assure a quick and reliable diagnosis of the disease. Because of the lack of slitlamp and corneal microscope, I have had to be content with the aid of a loupe ($\times 20$), but by this means every single case of trachoma is viewed under good focal illumination, and the state of the cornea, particularly of the upper limbal region, is carefully examined.

Following this procedure, I have been able to find that a very high percentage of

* From the Eye Department of the Chungking Army Hospital.



Figs. 1 to 5 (Kuo). Fig. 1, Incipient pannus; early stage of development. Fig. 2, Incipient pannus; beginning stage. Fig. 3, Incipient pannus; advanced stage. (The extension of the pannus vessels is exaggerated in this drawing, which actually seldom exceeds 2 mm. below the lower margin of the overhanging limbus. The horizontal demarcation line shows the position of the epithelial elevation.) Fig. 4, Pannus tenuis; beginning stage. Fig. 5, Pannus tenuis; advanced stage.

cases of incipient trachoma, some even of mild clinical nature, is accompanied by beginning invasion of fine capillaries from the engorged pericorneal vascular plexus into the transparent cornea immediately under the upper limbus. The percentage of this finding is, in fact, so high that one seems justified in designating this sign as pathognomonic for all cases of beginning trachoma. It would be even more apparent if the cases could all be examined under the corneal microscope with the aid of a slitlamp.

INCIPIENT PANNUS

This initial corneal neovascularization, or incipient pannus, as it is to be called, is characterized at its very beginning stage by the presence of fine, short capillary sproutings from the apices of the pericorneal vascular loops (fig. 1) into the transparent cornea, presumably under the epithelium, but above Bowman's membrane.

The looping plexus, which appears somewhat engorged, is clearly visible on the white, opaque background of the overhanging (exaggerated) crescent of the upper limbus. The capillary sproutings, however, are visible only under good oblique focal illumination, without glare, and careful search with the loupe. During this examination the patient has to look downward so as to expose the upper limbus directly to the field of examination.

The white, overhanging limbus, which is invariably present in all Chinese patients, with its crescent form and characteristic network of more or less engorged blood vessels, should not be mistaken for the pannus itself.

This blood-vessel network or vascular plexus presents the picture shown diagrammatically in figure 1, with the slender, lighter arterial branches going over to the grosser, darker venous twigs through many looping formations. The latter part

seems to lie more superficially in front of the former.

The picture is essentially the same as that produced by Leber¹ for "das Randschlingennetz im Limbus." Capillary sproutings are seen shooting from the apices of the vascular loops into the transparent part of the cornea, forming a row of fine, short blood vessels, ending abruptly, almost in a line concentric to the upper limbal margin (fig. 2). These initial capillary sproutings seldom show any side branches forming anastomoses. If they are already filled with blood, they can be seen very clearly under the magnifying loupe ($\times 20$).

Not infrequently, however, they appear in the form of very fine colorless lines, almost indistinguishable from their surrounding medium, probably because they are not yet filled with blood or have already become obliterated during the healing process of trachoma.

Since the overhanging limbus goes only gradually over into the transparent cornea, leaving a rather blurred and indistinct margin, it is sometimes difficult to judge whether the short sproutings are still within the crescent or already in the region of the transparent cornea. The chief criterion for decision is, therefore, the behavior of the apices of the capillary loops. Any "buddings" from these formations must be regarded as being suspicious in nature, even when they may not appear to lie entirely in the transparent corneal region.

It should be noted that, in a large majority of cases, these beginning vascular sproutings are seen, within apparently normal transparent cornea, immediately beneath the opaque overhanging crescent of the upper limbus. It would seem that the vascularization process takes place before any apparent changes in the form of cellular infiltration under the corneal epithelium become evident. The presence

of Herbert's pits is encountered only in exceptionally rare cases.

The later stage of the sproutings is much easier to recognize. Here the capillaries usually reach a distance of 1 to 2 mm. beneath the upper limbus (fig. 3). through proliferation, they become more abundant in number, sending out side branches, so that a semilunar region of the cornea occupied by a delicate capillary network results.

If the pupil is fully dilated under a mydriatic, one can best watch the beautiful picture of this capillary plexus with a direct electric ophthalmoscope (+20) in the darkroom. During this examination, the patient looks downward, and the upper limbal region should be viewed from above. In this way, the vascularized corneal region comes partly under the field of the illuminated pupil, and the blood vessels appear as clear-cut, dark lines on a shining red background.

As the condition progresses, the blood vessels become more engorged and evident, sending out anastomoses to the fellow vessels, forming another series of capillary loops which, in turn, give rise to further capillary sproutings. Here the capillaries also end, quite abruptly; this time in an almost horizontal line.

Although the intercapillary spaces in this semilunar corneal region may remain apparently normal and transparent, that part of the corneal surface immediately central to the abrupt endings of the invading vessels now begins to present some epithelial elevation or unevenness, so that a more or less distinct borderline can be seen, separating the pannus region from the normal, transparent part of the cornea (fig. 3).

Farther ahead of the epithelial elevation, the corneal surface appears to be occupied by less sharply defined, superficial opaque lines going in the direction of the invading vessels or by a finely punctate

haziness (fig. 4) which results from the cellular infiltration under the corneal epithelium. This constitutes the cause of the impaired vision before the pannus vessels have quite reached the pupillary region.

What follows later in the pannus development no longer, in fact, belongs to the stage of incipient pannus. With the farther advance of the arcade of new capillary loops, a somewhat dense vascular plexus is at last formed (fig. 5).

As the process of the subepithelial cellular infiltration advances, the corneal epithelium over the pannus vessels becomes more rough and hazy. Cases have been observed in which finely punctate, grayish-white calcified, subepithelial aggregations are seen scattered on the dendritic branches of the anastomosing vessels, reminding one of snow flakes on a bare tree. Thus, the cornea appears definitely cloudy, uneven, and covered with engorged superficial blood vessels.

Different kinds of pannus trachomatous can be distinguished by the degree of the subsequent fibrous-tissue formation: pannus tenuis, when the blood vessels are scarce and the fibrous tissue thin and recent; pannus vasculosus, when the blood vessels are more densely arranged and engorged; pannus crassus, when greatly engorged blood vessels are seen on top of the thickened fibrous tissue, simulating a fleshy appearance; and pannus sarcomatosus, if this fleshy appearance is so pronounced as to give some degree of tumorlike prominence.

A STATISTICAL SURVEY

In order to ascertain to what extent the beginning stage of trachoma is actually associated with incipient pannus, my co-workers and I have utilized the material obtained from the mass physical examinations of marine volunteers in the Chungking Army Hospital during June, 1945,

to make a statistical survey on this subject. The examinees, a total of 2,370, were all males ranging in age from 20 to 35 years, inclusive.

Each individual was examined carefully for his conjunctival and, particularly, for his corneal condition. The corneal examination was made under loupe magnification and well-concentrated focal illumination. In each case, special attention was given to the upper limbal region.

As classification for the trachoma itself, the system of McCallan was adapted. Among the total of 2,370 persons thus examined, 1,692 individuals, or 71.392 percent, were found to be suffering in various degrees from the disease.

The number of individuals suffering

TABLE 1

NUMBER AND PERCENTAGE OF TYPES OF TRACHOMA DIAGNOSED IN 1692 VOLUNTEERS

Stage of Trachoma (McCallan)	No. Individuals Found	Percentage in Forms of Total Trachoma Incidence
Trachoma I	1464	86.52
Trachoma II	193	11.40
Trachoma III	35	2.07
Trachoma IV	0	0.00

of mixed infection will be considered presently.)

Still more interesting are the interrelationships between the various trachoma stages and the various degrees of pannus formations as shown in table 2. It is

TABLE 2

STAGES OF TRACHOMA AND OF PANNUS IN 1692 VOLUNTEERS

Stages of Trachoma	Pannus incipiens		Pannus tenuis	
	number	percent	number	percent
Trachoma I (1464 cases)	1315	89.82	0	0
Trachoma II (193 cases)	184	95.34	9	4.66
Trachoma III (35 cases)	24	68.57	9	25.71

from different stages of trachoma and their percentages in terms of the total trachoma incidence are given in table 1.

It is significant that the incidence of trachoma III is low and that that of stage IV is altogether absent. This is probably due to the fact that those who should have reached stage IV have avoided examination, since they were fairly certain not to be accepted for the service. Another factor which may explain this low incidence is that among student bodies where personal habits of cleanliness are often emphasized, the possibility of mixed infection is greatly reduced. (The role

conspicuous that no higher degree of pannus formation than that of the tenuis type is found, in exact agreement with the relatively mild type of trachoma prevalent among the examinees.

The total number of pannus-positive cases associated with each stage of trachoma are shown in table 3. The total number of pannus-positive cases was 1,541 or 91.07 percent of the total (1,692) trachoma cases found.

[The incidence of color blindness is given here only for the sake of completeness. Among the 2,370 persons examined, 83 (3.50 percent) were found to be red-

TABLE 3
ASSOCIATION OF TRACHOMA AND
PANNUS IN 1692 VOLUNTEERS

Stages of Trachoma	Number of Cases	Total Number of Pannus- positive Cases	Per- centage
Trachoma I	1464	1315	89.14
Trachoma II	193	193	100.00
Trachoma III	35	33	94.27

green blind; 19 (0.8 percent) to be red-green-color feeble. Ishihara charts were used for the examinations throughout.]

The results of the data obtained may be summarized as follows: (1) A rather high percent (71.392) of Chinese young men are infected with trachoma. Since most of the volunteers examined were students from various middle schools and colleges, it can be said that the examinees were of the student class. (2) A majority (86.52 percent) of these cases could be classified in the early stage, or Trachoma I. Only small percentages are found in the second and third stages: trachoma II (11.40 percent); trachoma III (2.07 percent). Trachoma in the fourth stage was altogether absent. (3) Close relationships are observed between the stage of the trachoma and the degree of the pannus formation in a progressive proportion (table 2). The incidence of incipient pannus to trachoma in its very early stage is found to be sufficiently high (89.82 percent) to justify its diagnostic value. This is especially significant when it is considered that, had the slitlamp been used, a full percentage of the incidence might have been anticipated.

DISCUSSION

The significance of incipient pannus for the early diagnosis of the early stage of trachoma can be fully appreciated only when one admits that the corneal affection is specific and primary in nature and

not to be regarded as a secondary infection from the palpebral conjunctiva. This was once a controversial point.

Statements are frequently made that the corneal process is but a result of the constant rubbing of the rough conjunctival surface against the cornea so that the corneal epithelium is mechanically inoculated with the trachoma virus. Accordingly, the development of pannus trachomatous never takes place before the trachomatous process on the lid conjunctiva has reached a certain degree of intensity.

This concept seems further strengthened because of the apparently normal condition of the bulbar conjunctiva during the specific process of inflammation. Since the introduction of the slitlamp examination into the field of clinical ophthalmology, however, this concept has been proved erroneous.

As mentioned by Duke-Elder,² it was Busacca (1933) who studied the biomicroscopic and histologic pictures which occur in the corneal epithelium as initial changes of the trachomatous process. Busacca found that these initial changes usually take the form of an avascular, superficial keratitis; that the picture suggests a primary attack on the corneal epithelium by the virus; that the subsequent vascularization or pannus formation is but a defense reaction of the normally avascular tissue to the invading virus.

In addition to this, the most recent histologic research has proved definitely that the bulbar conjunctiva is involved at the very beginning stage of the disease in the form of subconjunctival cellular infiltration, especially of plasma cells, usually with cellular accumulations in the region of the blood vessels and sometimes with the formation of true follicles.

To use the words of Duke-Elder: "The disease is less fully developed than in the palpebral conjunctiva, but it may attack

the bulbar conjunctiva first, and the evidence points to the fact that it is a primary infection and not a mechanical contact infection from the lid."

In describing the condition of the cornea, it was specifically mentioned "that some degree of pannus is present in every case of trachoma and that in many cases its earliest stages are detectable by the slitlamp contemporaneously with the appearance of the first signs of inflammation in the conjunctiva tarsi. These facts indicate that the corneal infection is specific and primary, not secondary and incidental."

That incipient pannus must appear in every case of early trachoma is, therefore, not a matter of speculation, but a matter of theoretical possibility. The relatively low incidence of 89.82 percent in the present series is to be ascribed entirely to the use of a loupe, the magnifying power of which is, naturally, not to be compared with that of a corneal microscope, aided by an ideal focal illumination of the kind afforded by the slitlamp.

As far as the present material is concerned, the sequence between the vascular neof ormation and the subepithelial infiltration remains somewhat obscure.

Busacca's opinion that the vascularization is consequent upon development of the so-called avascular keratitis, and thus is to be regarded as a defense reaction against the invading virus, has already been pointed out.

Throughout the entire loupe examination, I have missed in a great majority of cases any signs on the cornea which might be ascribed to the process of a keratitis, although the subsequent infiltration following the incipient pannus is usually demonstrable even with the aid of a loupe, as seen in the foregoing descriptions. It would appear that at the very beginning stage of trachoma, at least, the vascularization takes place before any cellular in-

filtration becomes evident. However, this may prove to be deceptive because the loupe magnification is insufficient for detecting minute beginning changes which might possibly have taken place beneath the epithelium.

Another controversial point concerns the primary site of the vascularization process in relation to Bowman's membrane. Those who regarded the corneal infection as a contact infection once believed that vascularization first takes place under Bowman's membrane, leaving the epithelium more or less intact. Actually, however, the pannus vessels first creep between the epithelium and Bowman's membrane, indicating that it is the former which is primarily affected, analogous to the condition prevalent simultaneously on the conjunctiva.

The last strong evidence which speaks for the primary character of the corneal infection is clearly shown in the data presented in table 2. Here it is seen that the degree of pannus formation increases as the stage of trachoma advances. Whereas, incipient pannus appears uniformly in all stages of trachoma, the tenuis type is entirely absent in stage I, but increases to 4.66 percent and 25.71 percent in stages II and III, respectively.

This shows clearly that the trachoma infection attacks both conjunctiva and cornea at the same time so that the disease progresses simultaneously in both instances.

On the other hand, it is evident from the data of the same table, that pannus incipiens, although typically present in trachoma I (89.82 percent), is also found in stages II and III with the impressive incidences of 95.34 percent and 68.57 percent, respectively.

Apparently, pannus incipiens does not necessarily advance with the same speed of progression as do the conjunctival signs. Indeed, in its beginning stage, it

seemed to persist as the changes in the conjunctiva advanced. The explanation for this is most likely to be found in the role played by mixed infection. It is routine clinical experience that any preëxisting, nonspecific conjunctivitis constitutes a predisposing factor for contracting trachoma. Similarly, any trachomatous inflammation may be aggravated by a secondarily contracted, nonspecific mixed infection which causes acute inflammatory signs and thus obscures the actual stage of the specific disease. The mixed, infective agents, being nonspecific in nature, attack the conjunctiva primarily or exclusively, usually leaving the cornea free at the beginning stage. This leads to the apparent discrepancy between the two structures specifically involved.

Although the presence of mixed infection may influence the course of trachoma in the manner described, it is mainly the absence of mixed infection that has caused the predominance of beginning trachoma over the more advanced stages.

The better hygienic environment and personal cleanliness of student groups in general have already been taken into account. On the other hand, among trachomatous patients who live in unsanitary environments and have the undesirable habit of rubbing their itching eyes with dirty fingers, the incidence of mixed infection is astonishingly high.

Another clinical discrepancy not observed in the present series of data, but not infrequently encountered in one's daily practical experience, is the presence of a somewhat advanced pannus in association with a relatively harmless conjunctival manifestation.

This condition is often encountered in individuals of poor social and economic standing; in whom subclinical, nutritional deficiencies of some kind or other are bound to be more prevalent. One seems to

be justified in making the assumption that certain states of malnutrition (or undernutrition) may in some way contribute to the increased pannus formation of the cornea.

Nutritional research workers³ like Spies, Vilter, Ashe, Day, O'Brien, and especially Bessey and Wolbach, have established a clinical entity of the so-called "nutritional keratitis" as the earliest and most constant clinical manifestation of ariboflavinosis. This nutritional keratitis, which is characterized by superficial corneal vascularization from the upper corneal limbus, presents a picture of exactly the same morphology as that which describes incipient pannus. If it is too speculative to draw any conclusion from these purely morphologic similarities, it is, nevertheless, worth our closest attention and should be reserved as a problem for further investigation.

In this connection, it is interesting to mention the observation made by Victoria⁴ about an attenuated trachoma found endemically in northern Argentina. It is supposed to be a very mild type of trachoma, characterized by a slightly hyperemic conjunctiva and increase of limbal vascularization, with a few loops invading the cornea for a distance not greater than 1.5 to 2 mm.

This precisely confirms my own observations of trachoma in its very beginning stage, and it is evident that in so far as the pannus picture is concerned, we are both dealing with the same stage of the disease. The term "attenuated trachoma" is certainly misleading, because pannus incipiens is only a sign of the very early stage of trachoma which tends to progress and not of any independent category of the disease.

To sum up, then, one may say that trachoma is an infectious disease which affects both conjunctiva and cornea simultaneously, although certain local (mixed

infection) or general (undernutritional) conditions may aggravate one or another process so as to cause some discrepancy between the severity of conjunctival and corneal clinical signs. Pannus incipiens is the earliest detectable sign in the cornea, just as is subconjunctival infiltration in the conjunctiva.

The presence of neovascular sproutings from the upper limbal region into the transparent part of the cornea is, therefore, pathognomonic for the early stage of trachoma and may serve as a criterion for an early diagnosis of the disease.

The clinical application of incipient pannus in the diagnosis of beginning trachoma is to some extent, however, a circumstantial one. One or two sporadic vascular sproutings are not to be regarded as too significant. It is only when a large number of neovascular sproutings are present contemporaneously with coexisting conjunctival signs that a diagnosis of trachoma is justified.

Indeed, pannus plexus of extremely fine, delicate texture may persist long after trachoma I has healed without leaving even a trace of scarring on the conjunctiva. A diagnosis of beginning florid trachoma in such cases would certainly be a serious mistake.

Among the conjunctival signs, I lay more stress on the general haziness of the lower cul-de-sac, which is, to my mind, almost universally present as a result of subconjunctival infiltration and is, therefore, only secondary in importance to incipient pannus for the clinical diagnosis. A combination of incipient pannus with a more or less pronounced degree of peculiar haziness of the lower cul-de-sac guarantees the diagnosis almost with certainty. This is so even if the hypertrophic signs in the tarsal conjunctiva are so slight as to be almost absent.

SUMMARY

The difficulties in the diagnosis of beginning trachoma are discussed. A method for prompt, but decisive, diagnosis of the early stage of trachoma becomes urgent.

Careful examination of numerous beginning trachoma cases with a loupe under focal illumination usually reveals, in a very high percentage, positive neovascular sproutings from the pericorneal vascular loops of the upper overhanging limbus into the transparent part of the cornea. This condition is known as incipient pannus of trachoma.

Data from a mass of physical examinations of 2,370 marine volunteers are presented to substantiate the practicability of this clinical sign for the early diagnosis of the disease. It was found that 89.82 percent of the early trachoma cases showed positive incipient pannus formation, although a much higher percentage should be expected from a general, theoretical consideration, which suggests that the corneal infection of trachoma is of a primary nature and not the result of contact with an infected lid.

The infection of the conjunctiva and that on the cornea take up a parallel course of development, and incipient pannus is but an early sign of the corneal infection just as the subconjunctival infiltration is of the conjunctival reaction.

The primary nature of the corneal infection is indicated by: 1. The simultaneous appearance of the conjunctival and corneal changes. 2. The strict localization of the pannus vessels between the epithelium and Bowman's membrane. 3. The early involvement of the bulbar conjunctiva in the infection. 4. The fact that, as a rule, the degree of pannus formation increases as the stage of the trachoma advances.

Emphasis is placed upon the combined haziness of the lower cul-de-sac as indication of trachoma in its early stage.

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EXOPHTHALMIC OPHTHALMOPLÉGIA AND ITS RELATION TO THYROTOXICOSIS

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The classical signs of thyrotoxicosis include the ocular conditions of lid retraction and exophthalmos as well as the general effects of a raised basal metabolic rate, loss of weight, tachycardia, and tremor. The exophthalmos may be apparent only in life, disappearing on deep anesthesia or death, or may be real and persisting, when it should properly be called proptosis. In some cases there is also a disorder of function of some or all of the extrinsic ocular muscles (ophthalmoplegia), as well as edema of the lids and conjunctiva. The question is further complicated by the fact that proptosis and ophthalmoplegia may occur in a patient with none of the other signs of thyrotoxicosis, and, indeed, in patients whose basal metabolic rate is low, or whose thyroid glands have been partially removed prior to the appearance of any eye signs.

The experimental work of Marine and Rosen, of Smelser, and of Pochin, and the clinical observations of Russell Brain, Rundle, Mulvany, and others have done much to elucidate the problems of the relation of the eye signs to the endocrine imbalance and of the gradations, combinations, and varieties of exophthalmos, proptosis, lid edema, ophthalmoplegia, and altered basal metabolic rate which may occur in man.

The discovery of the thyrotropic hormone of the pituitary marked the beginning of the rational comprehension of the interaction of the thyroid and the pituitary in the production of these varying ocular complications. The linkage of animal experiment to clinical findings and to treatment is still, however, incomplete, and the present series of patients is shown in an attempt to clarify the still outstanding problems and to indicate how far the experimental work can be of use in interpreting individual cases.

As Marine and Rosen (1934) and Smelser (1936) pointed out, both exophthalmos and proptosis can be produced experimentally. Widening of the palpebral aperture and slight protrusion of the eye can be produced in many animals by any agent which stimulates smooth muscle. It is transient and disappears on anesthetizing or killing the animal. It is prevented by removal of the cervical sympathetic. These experiments in part explain the lid retraction and staring look of thyrotoxic patients, who do not show proptosis or ophthalmoplegia. That proptosis in man is not to be explained in this way has been pointed out by Russell Brain and illustrated by a case in which proptosis developed in a patient with paralysis of the cervical sympathetic from a pre-

vious syringomyelia. Smelser further pointed out that extracts of the anterior lobe of the ox pituitary produced a true proptosis (persisting after death) in guinea pigs from which the thyroid glands had been previously removed. He has followed up these observations with experiments extending over eight years and has obtained results of great importance. These may be summarized:

If a series of guinea pigs be subjected to thyroidectomy and to unilateral removal of the cervical sympathetic ganglion so as to produce a slight unilateral ptosis, and then injected with extracts of ox anterior-lobe pituitary or Antuitrint, it will be found that proptosis develops to an equal extent on both sides. This proptosis may be slightly masked on the one side by the drooping lid, but after death and removal of the lids and skin of the head it is seen to be equal on the two sides and to be directly due to increase of the orbital contents.

Estimation of the constituents of the orbital contents shows the increase to be 100 percent in the fat, 40 percent in the dorsal lacrimal gland, and 22 percent in the extrinsic muscles. Further investigation shows that the water content of all these tissues is much increased. If the orbital fat alone is examined no increase in lipid content will be demonstrated, but a connective-tissue hyperplasia and edema will be found to account for the 100 percent increase in the fatty tissue. Similarly, edema and round-cell infiltration of the muscles will account for their increase also. Smelser has shown that this process of connective-tissue hyperplasia and water retention is not, in the guinea pig, confined to the orbital fat but also involves other body fats, originally rich in connective tissue, such as the retroperitoneal, paraovarian, and paraureteral fat, but not the subcutaneous fat, where the connective tissue is sparse. Increase in bulk

of these fats will naturally be apparent only in the orbit, where the walls are rigid and expansion can only take place in one direction.

The condition of the extrinsic ocular muscles is interesting, and a certain amount of doubt still exists as to whether changes in the muscle fibers themselves are present in all cases, as Mulvany suggests, or whether they are merely secondary to the edema and small round-cell infiltration.

It would appear that in guinea pigs, at least, the increased water content of the orbital tissues is primary, and the hypertrophy of the muscles secondary. If one eye is excised at the beginning of the experiment, the contents of the orbit increase equally on both sides, but the muscles do not hypertrophy on the anophthalmic side. On the other hand, if proptosis is produced by entirely different means in intact guinea pigs (as by a uterine graft behind the eye made to hypertrophy by estradiol benzoate), the muscles hypertrophy in response to the pushing forward of the eye, but there is no increase in the water or fat content of the whole orbit.

These experimental results have been in part confirmed on human material, which shows similar histologic changes in the connective tissue of both orbital fat and lid subcutaneous tissue, and rather more change (hypertrophy and fragmentation) in the muscles, with late secondary fibrosis in cases of long standing.

The effects described in guinea pigs are undoubtedly due to excess of the anterior-lobe pituitary secretion, since the thyroids had been removed. The effects of excess thyroxine in guinea pigs are entirely different. Proptosis is never produced. The animal loses weight, and there is finally enophthalmos from absorption of orbital fat. Marine and Rosen, how-

ever, consider that sympathetic stimulants, which produce lid retraction and transient exophthalmos from contraction of smooth muscle, act more readily in the presence of excess thyroxine. This may be due to sensitization of unstriated muscle by the thyroxine, or associated with a myasthenic weakness of striped muscles as described by Mulvany.

It therefore seems likely that, clinically, we should be able to distinguish these various primary and secondary effects of excess pituitary thyrotropic hormone from the effects of excess thyroxine and possibly coincident excess adrenalin acting on thyroxine-sensitized structures or against thyroxine-weakened antagonists.

We are looking for three sets of eye signs; namely, signs of overaction of unstriated muscle (lid retraction and exophthalmos abolished by anesthesia), signs of weakness of striped muscle (ophthalmoplegia), and signs of increase in bulk (water retention) in the orbital and lid tissues (proptosis; chemosis and edema of lids). General changes due to excess or deficiency of thyroxine (raised or lowered basal metabolic rate and loss or gain in weight) may also complicate the picture.

In addition, in man, we are confronted by the possible action of the central nervous system acting through the hypothalamic structures as the stimulant or depressor of the pituitary. This aspect must always be remembered. Its importance was pointed out by Russell Brain in 1936, when he stated that, in the majority of his patients with exophthalmic ophthalmoplegia, there was a history of mental shock or emotional strain from extrinsic causes. Purely psychogenic sources of emotional disturbance were conspicuously absent.

The assumption has been made by Mulvany, from observation of clinical material and pathologic examination of

orbital tissues in man, that two completely distinct conditions exist: one due purely to excess of thyroxine, the other due to excess of anterior-lobe pituitary hormone. This latter will, under certain conditions, lead to excess thyroxine by stimulation of the thyroid gland, if this is capable of responding. He designates the first condition "thyrotoxic ophthalmoplegia" and the second "thyrotropic exophthalmos."

In thyrotoxic ophthalmoplegia there is weakness of extraocular muscles accompanied by spastic contraction of the unstriated muscle of the lids and orbit from overaction of the sympathetic (possibly sensitization to adrenalin by the thyroxine). This leads to retraction of the upper lid, exophthalmos which can be at least partially reduced by steady pressure on the globe, and some weakness of muscular action (ophthalmoplegia). There is no increase in orbital contents, no edema of the lids, nor enlargement of the lacrimal gland. The lids are soft and flaccid and the eyeball moves freely when palpated in the socket.

In thyrotropic exophthalmos, on the other hand, Mulvany considers that excess anterior-pituitary hormone produces marked structural changes in the striped muscles of the orbit as well as true increase in volume of the orbital contents, with severe edema of the lids, orbital contents, and conjunctiva. Ophthalmoplegia as well as proptosis results, and the eyeball cannot be pressed back nor moved freely about in the orbit.

According to Mulvany, degenerative change in the striped muscles is produced by an excess of thyroxine alone, and this change can be distinguished microscopically from the fibrosis and edema of these muscles produced by excess thyrotropic hormone. It is, however, difficult to accept the two appearances as separate pathologic entities, since fibrosis would be

the predicted end result of the changes ascribed to excess thyroxine.

It seems more likely that the degeneration is a continuous process, due solely to the pituitary hormone but capable of coexisting with the effects of excess thyroxine (contraction of smooth muscle and wasting of orbital fat) and clinically somewhat masked by them. It is well known that in thyrotoxicosis, as from a thyroid adenoma, there may be a high basal metabolic rate (B.M.R.), loss of weight, tachycardia, sweating, and tremor, but no ophthalmoplegia; whereas, in cases of excess thyrotropic hormone with a low B.M.R. there is practically always some ophthalmoplegia. Clinically, however, in most cases of raised B.M.R. (thyroxine excess) not associated with thyroid adenoma, there is a pituitary element manifesting itself as edema of the lids and weakness of some or all of the eye movements. It is, therefore, simpler to look on lid retraction as a sign of excess thyroxine and defective eye movement (which actually may be present without proptosis) as resulting from excess thyrotropic hormone.

The present series of cases has been studied in an attempt to disentangle the parts played by the thyroid and the pituitary, respectively, in individual patients, and it is hoped to show that the two conditions described by Mulvany and produced experimentally may coexist or overlap. The 18 cases are grouped on the presumptive evidence of the probable single or multiple endocrine disturbance underlying them. Purely thyrotoxic cases have not been included, as the problem has been tackled chiefly from the pituitary point of view.

The cases seem to fall into three groups:

Group I. Primary deficiency of thyroxine with compensatory excess of thyrotropic hormone secretion (4 cases).

Group II. Primary excess thyroxine as initial symptom followed by thyroid atrophy or removal, replaced by excess thyrotropic hormone (10 cases).

Group III. Excess thyroxine and excess thyrotropic hormone arising simultaneously (4 cases).

CASE REPORTS

GROUP I. PRIMARY THYROXINE DEFICIENCY WITH COMPENSATORY EXCESS THYROTROPIC HORMONE

Three women and one man fall into this group. They were all between 50 and 60 years of age (average 54). One patient gave a history of fright in an air raid and one of overwork. The other two could assign no cause and were not neurotic personalities.

In all four patients there was edema of the lids and, in three, of the conjunctiva also. The lids appeared puffy, stiff, and showed poor movement. In three cases the lids could not be completely closed, but lid retraction was not present, and the appearance did not suggest thyrotoxicosis. The patients' skin was sallow, thick, coarse, and slightly suggestive of myxedema. The proptosis (in three) could not be reduced by pressure, and the B.M.R. in the three cases in which it is known was subnormal (—9 percent; —27 percent; and 0 to —1 percent). In two of the cases one eye was lost from exposure before I saw the patient, but the other eye was saved by tarsorrhaphy and excision of conjunctiva, the patient being put on thyroid extract until the B.M.R. was well raised. One case was seen very early and required no local treatment. In the fourth case there was partial tarsorrhaphy, and the patient's eyes were saved, although she showed many anomalous features and her early history is obscure.

Case 1. Miss E. G., aged 54 years (figs.



Figs. 1-4 (Mann). Group I, Case 1, Miss E. G., aged 54 years. Fig. 1, the patient on October 23, 1942. B.M.R., -27. Note the edema and pouching of the lower lids, the slight fullness above the eyes with commencing overhang of the tissues of the upper lid. There is no lid retraction, but the left eye is slightly more prominent than the right and the upper lid more swollen. Fig. 2, same date, showing the lids from the side. The edema is obvious, although not yet excessive. Fig. 3, the patient on January 29, 1945—B.M.R., +12—after treatment with 2 gr. thyroid extract per day. The edema of the lower lids has completely disappeared and the skin crease in the upper lids is now raised. Fig. 4, same date as in figure 3, shows the side face. Comparison with figure 1 demonstrates the disappearance of the edema. The left eye is now more widely open, as the lid is not so heavy.

1, 2), presented the earliest case observed in the series and was diagnosed and treated before the signs of compensatory pituitary activity became at all marked. The patient stated that since coming to live in High Wycombe, four years previously, she had felt "old and tired." Her skin had become dry, and she noticed extremes of temperature more than heretofore. Her eyelids, especially the lower lids, had become very puffy during the last year. She appeared somewhat slow and depressed in manner. Her color was good, but the skin below the lower lids was edematous and pouched. The left eye was slightly more prominent than the right. There was no limitation of movement. She showed early senile cataract. Vision was 6/12 with correction of low myopia. There was a small choroidal scar in the fundus of the left eye.

The patient was 5 ft. 4 in. in height; weighed 119 lbs. Her pulse rate was 80, and the B.M.R. -9 percent.

The clinical evidence appeared to be against myxedema. (She was mentally alert and not markedly gaining in weight.) She was treated with thyroid extract (2 gr. per day) and reported after six months that she felt "a new woman," and that all the swelling of the lids had disappeared. The skin of the lids was soft and normal, and the proptosis of the left eye had disappeared (figs. 3, 4). Her B.M.R. was +12, and the pulse 80. She has continued well on this dose of thyroid for two years.

Case 2. Mrs. B. P., aged 54 years, was well until 1941, when she was badly frightened in an air raid. A fortnight after this her eyelids began to swell and her eyes to protrude. In two months she became unable to close them completely, and the cornea of the left eye ulcerated. Her skin was dry and her pulse slow.

The patient was 5 ft. 1 in. in height and

weighed 120 lbs. Her pulse rate was 80, and her B.M.R. -27 percent.

She developed a hypopyon ulcer in the left eye, and this eye was excised. After excision of the eye, the tissues in the socket continued to increase and bulged slightly between the lids. (This is reminiscent of Smelser's aforementioned observations on guinea pigs.) The right eye became increasingly proptosed, and there was limitation of upward and downward movement. Eight months after the air raid, she was admitted to the Oxford Eye Hospital and treated by tarsorrhaphy of the right lids and 3 gr. of thyroid extract a day. In three months her weight had dropped to 105 lbs. and her B.M.R. was +14 percent; pulse 64. She stated that she felt very well. The eye movements had improved, the proptosis was less, and vision was 6/12. She was advised to continue the thyroid but to decrease the dose slightly. She attended four months later, having gained two pounds in weight, when the B.M.R. was -4 per cent. She appeared well, but will probably have to continue on thyroid extract indefinitely. She appears to have been an early thyroid failure in whom fright had produced an excess of anterior-pituitary secretion, but no coincident increase of thyroxine, as a relatively large dose of thyroid was required to raise her B.M.R.

Case 3. Mr. F. A., aged 57 years, had to work overtime in very bad conditions from March, 1941. He noticed some fullness of his neck and puffiness of both upper and lower lids, but no protrusion of the eyes. Soon after this he complained of double vision. In September, 1941, he was admitted to the Oxford Eye Hospital (fig. 5). The patient was 5 ft. 6 in. in height and weighed 149 lbs. His pulse rate was 60, and his B.M.R., 0. He was a pale, rather stout man, with thickened skin and heavy features, sug-

gestive of myxedema. All four lids were edematous, brawny, and immobile. There was complete external ophthalmoplegia, but practically no appearance of proptosis. As the eyes and lids were immobile, there was no protection of the corneas in sleep, and the right eye had a severe, perforated hypopyon ulcer. Vision of the left eye was 6/9. The brawny swelling of the lids could be reduced by massage, but

was then put on 3 gr. of thyroid extract a day, when he began to improve rapidly and was discharged. He decreased the thyroid extract, and, on readmission, two months later, his weight had increased to 170 lbs. and his B.M.R. was -1 percent, his pulse rate 60. He has since been stabilized on 1 gr. of thyroid extract a day. His weight is 157 lbs., his B.M.R. +3 percent, and his pulse 50 (fig. 7). The



Figs. 5-7 (Mann). Group I, Case 3, Mr. F. A., aged 57 years. Fig. 5 shows the patient on September 17, 1941. B.M.R., 0. The edema of the lids is extreme, and there is complete loss of movement of the eyes and lids. The eyes cannot be closed, and the right cornea has perforated from exposure. The patient's skin is coarse, and the general appearance should be compared with figure 26, which shows a very similar facies in a woman. Fig. 6 shows the patient on November 7, 1941, after removal of the right eye and of redundant edematous tissue from the lids. Massage has been employed freely after healing. He has not yet been treated with thyroid. Fig. 7, the patient on January 27, 1945, after treatment with 3 gr. thyroid extract per day, reduced subsequently to 1 gr. The skin of the lids is now soft, and the eye movements are improving. He has been fitted with an artificial eye and both eyes are now closed during sleep.

they could not be made to close. The eye appeared firmly imbedded and could not be made to move in the orbit on palpation.

Operation was performed for excision of the right eye, and partial tarsorrhaphy of the left lids, combined with a plastic operation on the upper lids in which the redundant folds of edematous skin were removed, and also portions of orbital tissue from the socket. Sections of all these showed extreme edema and slight connective-tissue proliferation. The operation wounds healed and the condition of the lids improved under frequent massage (fig. 6). His visual acuity, however, dropped to 6/36, and a patch of exudate appeared at the macula of the left eye. His weight increased to 162 lbs. in the two months following the operation. He

eye movements have improved, the macula is now normal and vision 6/6. He is doing full work and feeling very well. He resembles the previous case in that a period of strain was met by increased anterior-pituitary hormone, the thyroid failing to respond. It is interesting to note that the complete ophthalmoplegia and intense edema were not accompanied by much evident proptosis.

Case 4. Mrs. M. E. D., aged 47 years, presented a very complicated and anomalous case, but was placed in this group on account of the fact that the presenting symptom was gain in weight and presumptive early myxedema. The history was complicated by an attack of poliomyelitis at the age of 22 years, which left the patient unable to take much exer-

cise. I did not see her in the early stages of her later illness myself, but she stated that in 1938 she was treated for increasing obesity by thyroid extract. This was stopped; her eyelids then became swollen, and she was advised to have her thyroid gland removed. After the operation she developed severe proptosis, with complete paralysis of both internal recti, swelling of the lids, and chemosis. I saw her in 1940, and performed bilateral partial tarsorrhaphy. An attempt was made to treat her with thyroid extract, but she felt very ill and it was discontinued. She remained fairly well, but the proptosis remained and some limitation of movement until 1943 (but with good visual acuity—R.E. 6/9; L.E. 6/6), when she suddenly developed severe myasthenia gravis. This responded at the time to prostigmine, but she since relapsed and died of respiratory failure, a thymus tumor being found *post mortem*. The eye condition remained stationary, though she could not close her lids, owing to facial weakness, not to proptosis. This would appear to have been a case of primary thyroid failure, probably made worse by thyroidectomy and complicated by thymus tumor, but the early history of the case is obscure and exact data, including the B.M.R., are not available.

GROUP II. CASES IN WHICH THE PRESENTING SYMPTOMS SUGGEST EXCESS THYRONINE FOLLOWED BY THYROID FAILURE OR THYROIDECTOMY AND SUBSEQUENT EXCESS THYROTROPIC HORMONE.

Ten cases fell into this group, eight in women and two in men. Their ages ranged from 44 to 76 years, distributed thus: 44, 47 (2), 54, 56, 57, 60, 62, 71, 76. In seven cases there was a definite history of shock or mental strain followed by symptoms of hyperthyroidism. In three there was no history other than the usual complaint of overwork and war

anxiety. Of the seven cases in which there was a definite history, the shock in five was connected with the war; personal experience in air raids (2), death or injury of near relation (2), hardship over billettees (1). The sixth case was that of personal worry over a criminal member of the family, and the seventh, the shock of an operation for strangulated hernia. In two of these cases, there was a previous breakdown with tachycardia and loss of weight, following, in one case, a motor smash and, in the other, the death of a husband. In them all the history was of an illness characterized by loss of weight and tachycardia, followed either by recovery or thyroidectomy. Swelling of the lids, proptosis, and ophthalmoplegia then developed, sometimes after a second shock, sometimes independently. Six of the 10 patients had had a thyroidectomy with improvement, immediate but not maintained. The time elapsing between the thyroidectomy or the spontaneous remission of the tachycardia and the appearance of ophthalmoplegia varied from 14+ years in two cases, with history of second shock, to a few days in some of the thyroidectomized patients.

Case 1. Mrs. E. C., 44 years, had had attacks of tremor, tachycardia, and loss of weight but no proptosis in 1913, 1920, 1928, and 1941. All except the last were relieved by rest and sedatives. Thyroidectomy was performed in 1941, and was followed by tetany and proptosis. Within a month of the operation the eyes could not be closed, and there was ophthalmoplegia (fig. 8). The patient weighed 133 lbs., her B.M.R. was +3, her pulse 80, and visual acuity: R.E. 6/60, L.E. 6/24.

Bilateral tarsorrhaphy was performed, and the patient was put on 2 gr. of thyroid extract per day and calcium gluconate. In seven months her weight had decreased to 121 lbs., and the B.M.R. rose to +23.



Figs. 8-10 (Mann). Group II, Case 1, Mrs. E. C., aged 44 years. Fig. 8 shows the patient on September 24, 1942. B.M.R., +3. Thyroidectomy performed in 1941. This photograph was taken after a complete tarsorrhaphy in the right eye and a partial in the left. The lids are under some tension and the edema is obvious at the inner canthus. Fig. 9 shows the patient on June 25, 1943, after treatment with 2 gr. thyroid extract per day, and calcium gluconate. The B.M.R. is now +23, the lids are no longer tense, and the tarsorrhaphies have been partially reopened. Convergence has returned almost completely. Fig. 10 shows the patient on May 3, 1944, stabilized, with a B.M.R. of +12 and tarsorrhaphies further reopened. The movements of the right eye are full. Those of the left slightly restricted outward. Further reopening of the tarsorrhaphies can now be done as there is no edema of the lids and the proptosis is disappearing.

The patient felt much better, convergence returned, and visual acuity rose to R.E. 6/9, L.E. 6/12 (fig. 9). The fundi were normal. Two years after the tarsorrhaphy the condition was stabilized with a B.M.R. of +12, pulse 72, weight 123 lbs., and visual acuity of 6/6 right and left. The movements of the right eye were full, those of the left slightly restricted outward (fig. 10).

Case 2. H. W., a man, aged 47 years, had had a thyroidectomy in 1934. Proptosis had slowly increased since that time. He was treated for corneal ulcer in February, 1944. His height was 5 ft. 6 in., his weight 157 lbs., B.M.R., -10 percent, and pulse 84.

He was treated with 3 gr. of thyroid extract a day, and the eyes improved. Now he remains well on 1 gr. a day. The eyes are practically normal.

Case 3. Mrs. E. H., aged 47 years (fig. 11) had had a thyroidectomy in

1941. After a succession of war and family worries her eyes began to swell



Fig. 11 (Mann). Group II, Case 3, Mrs. E. H., aged 47 years, photographed on November 7, 1944. B.M.R., 0. Thyroidectomy in 1941. The patient had noticed protrusion of the eyes and puffiness of the lids, especially at the inner canthi, for two months. The photographs show the protrusion of the globe and the beginning edema, especially on the right, involving the upper lid at the inner end and also commencing below the lower lid. Compare figure 2, which shows edema in the same position, but without proptosis.

in September, 1944 (fig. 12). By March, 1945, there were severe chemosis, lid edema, and proptosis. The patient was feeling ill and complaining of gross defect in vision—R.E. less than 6/60; L.E. 6/12. There was some ophthalmoplegia (figs. 13, 14). The patient's height was 5 ft. 5 in.,

Case 4. E. S., a woman aged 54 years, had thyrotoxicosis after a motor accident many years ago, but recovered on rest. Three months ago she had much worry with billettees, and her eyes began to protrude. The B.M.R. was +58 percent. The patient's appearance indicated a typi-



Figs. 12-14 (Mann). Fig. 12, same case as in figure 11, shows patient on January 10, 1945. The swelling has increased enormously and the edema of upper and lower lids is marked. The conjunctiva is injected. The patient's skin is becoming coarser and she is gaining weight. Fig. 13 shows the patient on March 8, 1945. She has been treated with rest but has become steadily worse. There is gross edema, proptosis, and eversion of the lower fornix, which is partially strangulated by the lower lid. Fig. 14, same date, shows the condition on closing the eyes. The corneas are protected, but the conjunctiva is exposed. Thyroid treatment was commenced at this point.

her weight 128 lbs., her B.M.R., 0, and her pulse 68.

She was put on rest, 1 gr. of thyroid extract a day, and phenobarbitone. The condition grew steadily worse, and proptosis of the lower fornix occurred, necessitating tarsorrhaphy and excision of redundant conjunctiva on two occasions. The patient is still very ill and has gross field defects, but is definitely showing improvement. The dose of thyroid which gives the best results in 2 gr.*

* Since this paper was sent in for publication, this patient has continued to improve. The chemosis has subsided, the tarsorrhaphies have been reopened, and visual acuity is R.E. 6/24; L.E. 6/9. She is now living at home and doing most of her housework, after an illness of about a year.

cal thyrotoxicosis, but there was limitation of upward movement of both eyes



Fig. 14A (Mann). Mrs. E. H. five months after tarsorrhaphy of R.E. and thyroid treatment.

and proptosis. Thyroidectomy was performed in March, 1945. She is now feeling much better, but the proptosis is slightly worse. It appears that even before operation there was excess thyrotropic hormone, and it is doubtful whether this case will progress or not since the source of her worry has been removed.

Case 5. M. H., a woman, aged 56 years, had a thyrotoxicosis after a motor accident in 1927, with complete recovery on rest. In 1940, she was bombed and also very worried over a son in the army. Her lids swelled and her eyes became prominent soon after. A B.M.R. of +13 percent and a high blood-sugar curve were found. Ophthalmoplegia and diplopia developed, but never became excessive; after prolonged rest and treatment with aminophyllin the patient returned to full work and reported no diplopia (except

on extreme abduction) and no difficulty in closing the eyes.

Case 6. Mrs. D. D., aged 57 years, in five months lost 56 lbs., with sweating and palpitation, not associated with mental shock (weight then 98 lbs.). Thyroidectomy was performed. The eyes became more prominent soon after and remained so for four years, when she attended the Oxford Eye Hospital because of the discomfort from them (figs. 15, 16). Her height was 5 ft. 3 in., her weight 143 lbs., the B.M.R. -4, and pulse rate 64.

She was put on 2 gr. of thyroid extract a day, and immediately noticed improvement in the eyes. This dose was too large, and she began to lose weight rapidly. Vision was 6/5; the eyes prominent, but mobile. She is at present being stabilized.

Case 7. Mr. J. D., aged 60 years, in 1941



Figs. 15, 16 (Mann). Group II, Case 6, Mrs. D. D., aged 57 years. Fig. 15 shows patient on February 14, 1944. B.M.R., -4. Thyroidectomy performed four years previously. Note the fullness of the upper and lower lids and the overhang of the upper lid, which masks the proptosis (see Fig. 16). The eyeballs are prominent, but there is no lid retraction. Fig. 16, same date, shows fullness of upper lids but normal palpebral aperture in spite of proptosis.



Figs. 17, 18 (Mann). Group II, Case 7, Mr. J. D., aged 60 years. Fig. 17 shows patient on March 10, 1944. B.M.R., +29. This patient has not had a thyroidectomy, but is gaining weight. Note commencing proptosis with edema of upper lids. Fig. 18, same date showing overhang of upper lids but widened palpebral aperture. The B.M.R. is still raised, and lid retraction is therefore present as well as edema.

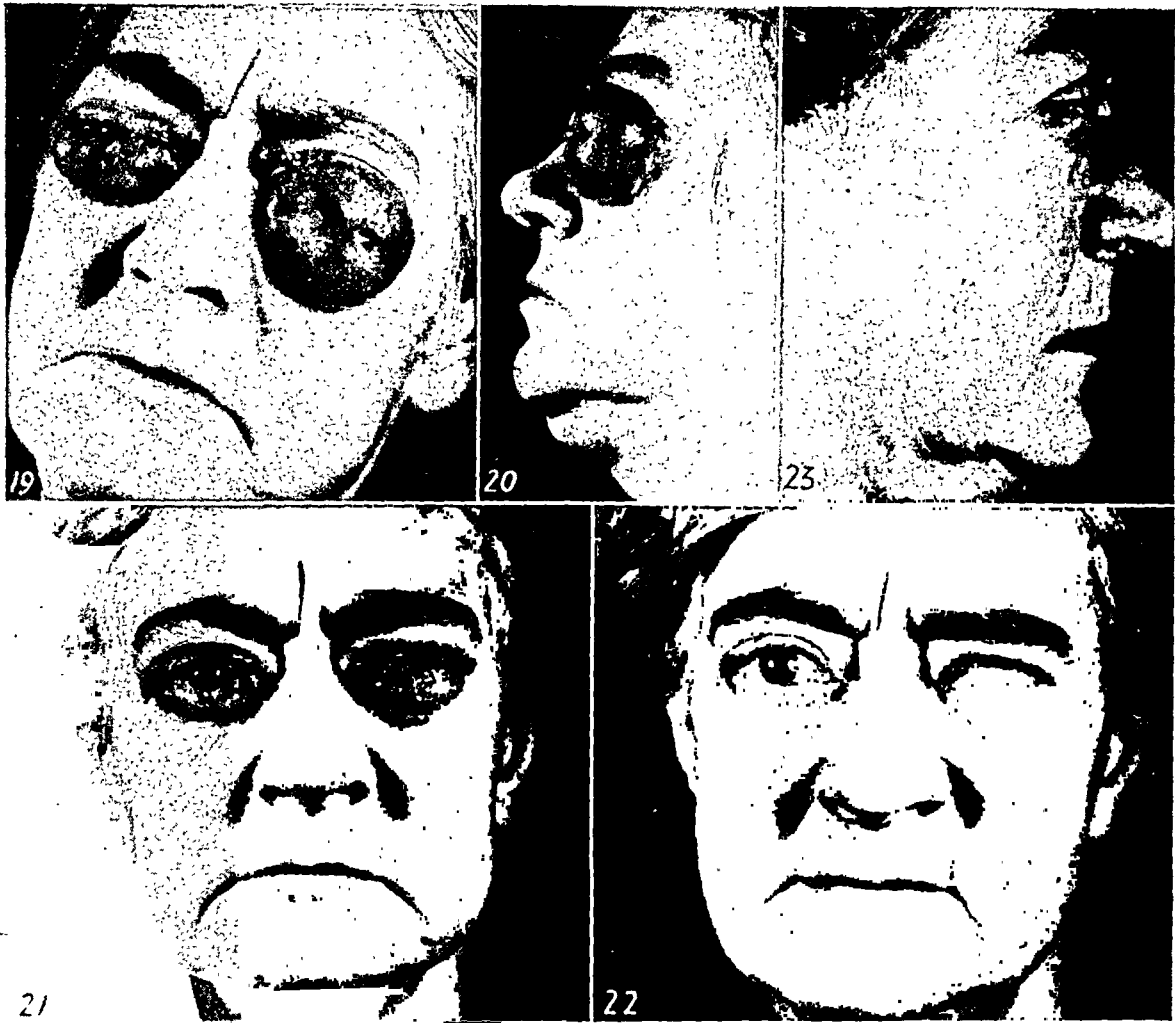
had vision of R.E. 6/6, L.E. nil (optic atrophy). This patient had an operation for strangulated hernia in June, 1942. He began to lose weight and went down to 109 lbs. In December, 1943, he had tachycardia, tremor, and commencing exophthalmos. By March, 1944, he had recovered largely from the tachycardia and tremor and was gaining weight, but the proptosis was increasing and there was ophthalmoplegia (figs. 17, 18). His height was 5 ft. 6 in., his weight 115 lbs., B.M.R. +29 percent, and pulse rate 90. Visual acuity, R.E., was 6/24.

A lateral tarsorrhaphy was performed. The patient improved on rest alone. His B.M.R. dropped to +27 and pulse to 76. Vision improved to 6/18, and he returned to work.

Case 8. Mrs. M. E., 62 years, had a great deal of family worry during 1941-42 and wept a great deal. She lost weight and her eyes watered, but did not become prominent until her thyroidectomy in

1944. She was in hospital a fortnight, and immediately upon returning home her eyes began to protrude. Within two months both eyes became grossly proptosed with ulceration and perforation of the left cornea and chemosis so great that the whole conjunctiva was everted and the lids could not be closed in either eye (figs. 19, 20). Complete ophthalmoplegia and edema of the lids were also present. She was admitted to the Oxford Eye Hospital. The patient's height was 5 ft. 3 in., her weight 110 lbs., her vision, R.E., was ability to count fingers at 2 ft. (veins very engorged); L.E., no light perception. The patient was too ill for B.M.R. estimation, but was gaining weight.

Operation was performed by Mr. Houlton: evisceration of the left eye and plastic operation on right and left eyes for removal of redundant conjunctiva and closure of lids. The patient was put on thyroid extract, gradually increased to 4 gr. a day (fig. 21) and reduced again finally to 0.5 gr. a day during the ensuing



Figs. 19-23 (Mann). Group II, Case 8, Mrs. M. E., aged 62 years, was photographed on June 1, 1944. B.M.R., +2. She had had a thyroidectomy in April, 1944. Fig. 19 shows gross edema of the lids, particularly at the inner canthi, and total eversion of the conjunctiva in the left eye, eversion of the lower fornix in the right. The cornea of the left eye is beginning to ulcerate. Fig. 20, same date, shows the patient from the left side with gross chemosis. Fig. 21 shows the patient on August 3, 1944, after treatment with thyroid extract gradually increased to 4 gr. per day, combined with excision of the left eye, partial tarsorrhaphy on the right, and removal of redundant conjunctiva. The orbital contents on the left continued to protrude after removal of the globe. Fig. 22 shows the condition on January 13, 1945. B.M.R., +2. The edema of the lids and the chemosis have disappeared. The contents of the left socket have receded, and the patient is looking much better. Fig. 23, same date, shows profile from the right side and demonstrates that there is now very little edema or proptosis.

eight months. A further tarsorrhaphy on the right eye became necessary and was successful. This eye was partially re-opened as the patient improved. Nine months after admission she reported fit and well, doing all her house work (figs. 22, 23).

Her B.M.R. was +2 percent, her pulse rate 74. Vision in the right eye was 6/24;

the fundus normal.

Eye movements are practically normal and chemosis and lid swelling have disappeared.

Case 9. Mrs. R. C., aged 71 years, had a history of a breakdown with loss of weight after the death of her husband, about 1920. In 1941, she became worried

about her son in the R.A.F. He was injured in 1943. In 1944, she was badly frightened by a motorcycle accident. She had been losing weight until then, and in 1944 her lids became edematous and her eyes prominent. There was slight limitation of movement and no gross chemosis, but swelling of the lids (figs. 24, 25). The retinal veins were full and there were

tivity in thyrotropic hormone production.

Case 10. Miss E. P. S., aged 76 years, made no complaint about her appearance, but stated when questioned that in 1940 she had had an attack of thyrotoxicosis which might have followed the bombing of her home. She was not certain of the sequence of events, but did not feel worried. Her eyes began to protrude; in 1941



Figs. 24, 25 (Mann). Group II, Case 9, Mrs. Rose C., aged 71 years, was photographed on November 21, 1944. B.M.R., +25. The patient had been losing weight since 1941, and in 1944 her lids became edematous. Fig. 24 shows the overhang of the upper lid, and the fullness of the whole orbit and contents. Fig. 25, same date, shows a slight lid retraction on the right, but on the left side the proptosis is masked by the overhanging lids.

two small choroidal scars. Vision was 6/6 with each eye. She was thin and appeared slightly thyrotoxic and was therefore put on phenobarbitone. Her weight was 91 lbs., her B.M.R. +25 percent.

She has remained well for six months, but there is more limitation of upward movement of the eyes. Hers would seem to be a case in which a thyrotoxicosis is subsiding spontaneously and is now giving place to symptoms of an increased ac-

she began to gain in weight, and her appearance suggested myxedema. She was put on 0.5 gr. thyroid extract per day and remained well.

She attended the Oxford Eye Hospital in 1942, with very defective eye movements, puffy lids, and proptosis (figs. 26, 27). Her weight was 149 lbs., B.M.R. -7 to -10 percent, her pulse rate 75, and vision with each eye 6/18 (high myopic correction).

Thyroid treatment was continued and increased to 1 gr. daily. The patient feels very well. Her vision has improved to R.E. 6/9; L.E. 6/12, and all eye movements have returned except that of the

mos in two cases. The B.M.R. in three was high (+38, +42, and +43 percent); in the fourth it was not tested before treatment. On this account they could not be given thyroid extract and were all



Figs. 26, 27 (Mann). Group II, Case 10, Miss E. P. S., aged 76 years, was photographed on October 23, 1942 (Fig. 26). B.M.R., -10. Gain in weight following mild attack of thyrotoxicosis two years previously. Her appearance should be compared with figure 5. Her skin is coarse and there is marked edema of the lids and overhang of the upper lid. There is limitation of ocular movements and proptosis, though this is masked by the lid edema. Fig. 27, same date, shows profile from the left side and demonstrates the edema of the orbital contents. The eye movements have since returned on treatment with 1 gr. thyroid extract per day.

left external rectus muscle, which is improving.

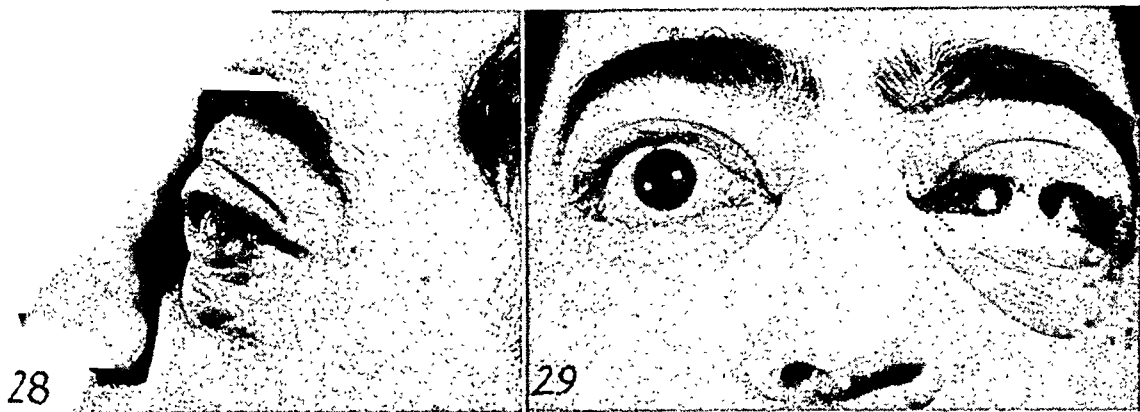
GROUP III. EXCESS THYROXINE AND EXCESS THYROTROPIC HORMONE ARISING SIMULTANEOUSLY.

Four cases fall into this group, in three men and one woman, aged, respectively, 42, 53, and 60 (2). Two gave a history of war experiences (shipwreck and bombing), and two of overwork in civilian life. In all four the symptoms were loss of weight, tachycardia, proptosis, and ophthalmoplegia, all coexistent, the loss of weight slightly preceding the exophthal-

mos treated differently on their individual merits.

Case 1. Capt. D. de C., aged 42 years, was torpedoed and shipwrecked. There followed loss of weight, severe proptosis, almost complete ophthalmoplegia, and corneal ulceration of the right eye (figs. 28, 29). The skin was moist, and there was a fine tremor. The patient felt very ill and anxious.

He was first treated with progynon, which made him feel ill, as did also Lugol's solution, which increased the chemosis. After a bilateral tarsorrhaphy, in-



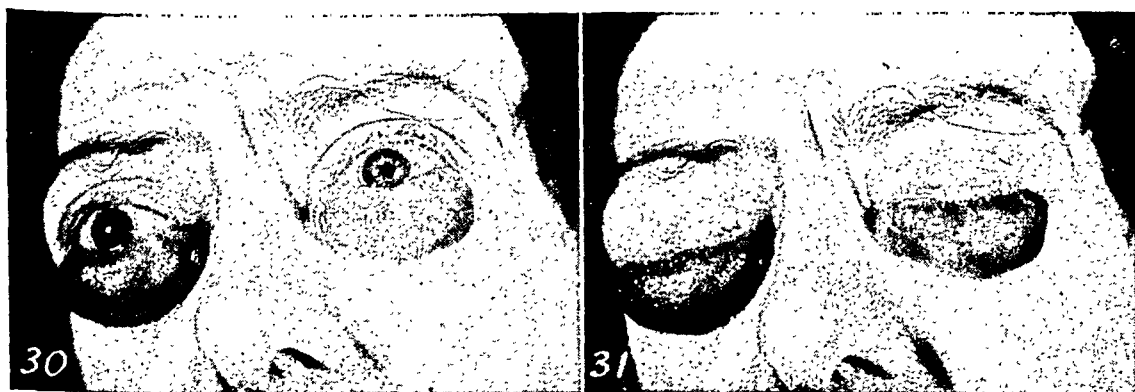
Figs. 28, 29 (Mann). Group III, Case 1, Capt. D. de C., aged 42 years, was photographed February 18, 1943. B.M.R., ?. Fig. 28 shows gross edema of the whole orbital contents and proptosis. The skin is moist, and there are signs of thyrotoxicosis. Fig. 29, after central tarsorrhaphy on the left. The edema is still greater on the left.

jections of testosterone were begun. After the fifth, he reported very great improvement in subjective sensations and greater comfort in his eyes. Twelve months after the beginning of his illness, he had returned to sea, having improved steadily. He reported, 12 months later, that he was doing full work, feeling well. His B.M.R. was now +10 percent, but he had rather prominent eyes.

Case 2. Mr. T. F., aged 53 years, was working hard but had always been nervous. In 1941 he lost weight, and noticed double vision. Within a year he was referred to the Oxford Eye Hospital with

bilateral proptosis, ophthalmoplegia, and eversion of the conjunctiva (figs. 30, 31). He stated that he had begun to gain slightly in weight, but that his eyes were becoming more prominent and fixed. His weight varied between 105 and 120 lbs. over a period of six months. His B.M.R. was +38 percent, his pulse rate 100. Vision was R.E. 6/24, L.E. 6/9. There was severe engorgement of the retinal vessels with papilledema.

Bilateral tarsorrhaphy and excision of prolapsed conjunctiva were performed (figs. 32, 33). The patient became very ill, anxious, and restless. Five weeks later he discharged himself and returned home.



Figs. 30-34 (Mann). Group III, Case 2, Mr. T. F., aged 53 years, was photographed January 27, 1942. B.M.R., +38. Fig. 30 shows gross edema of lids, orbital contents, and conjunctiva, with retraction of the upper lid, as he is still thyrotoxic. Fig. 31, same date, shows patient with the eyes closed. Compare this with figure 14.

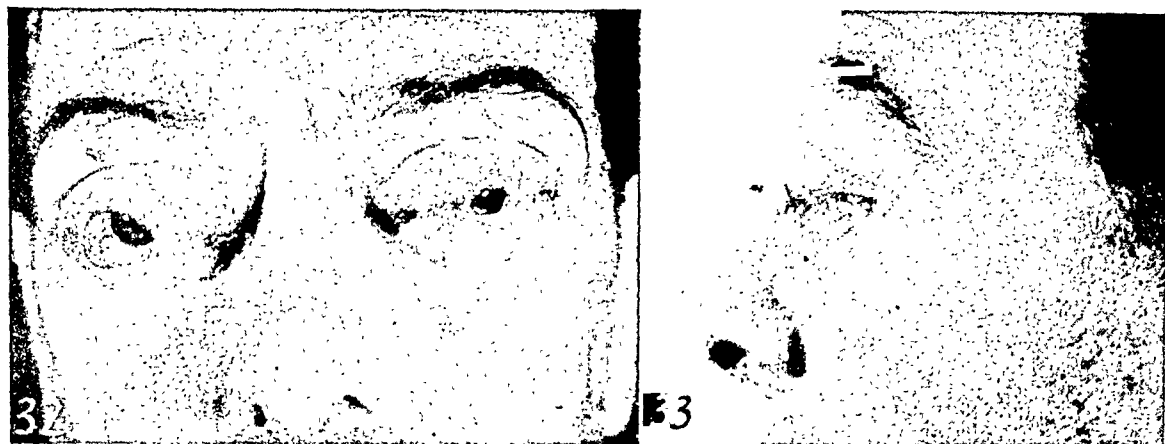


Fig. 32 shows the patient on March 19, 1942, after partial tarsorrhaphy and removal of excess conjunctiva. Fig. 33, same date, shows the protrusion of the orbital contents.

Subsequent reports show that he rested at home without treatment for some time and then had a course of deep X-ray therapy to the pituitary. He improved markedly. His weight rose to 134 lbs. and his B.M.R. decreased to +22 percent. Visual acuity improved to R.E. 6/9 and L.E. 6/5; the papilledema subsided. The eye movements remained limited and there was diplopia, which prevented his return to work (fig. 34).



Fig. 34, the patient on December 14, 1944, after treatment by prolonged rest and deep X-ray to the pituitary. The eye movements have partially returned, but he still has diplopia. The edema has subsided. Conjunctiva is normal.

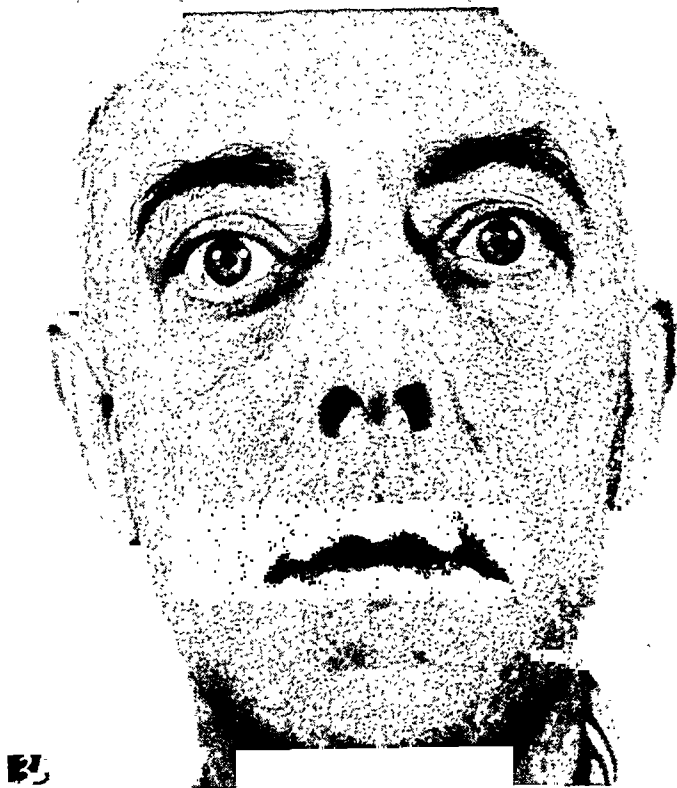
Case 3. J. P., a woman aged 60 years noticed loss of weight, breathlessness, and tachycardia with protrusion of the eyes after being in the London blitz in 1940. She lost 28 lbs. within a year. Her pulse rate was 120, the B.M.R. +32. Her skin was moist, and she had exophthalmic ophthalmoplegia.

A bilateral tarsorrhaphy was performed; a month later partial thyroidec-

tomy. A year later she returned, feeling very well. Vision, R. and L., was 6/6, and the eyes were practically normal. The tarsorrhaphies were undone with a very good result, only a slight von Graefe's sign remaining. In this case, the removal from London and consequent relief from anxiety together with partial thyroidectomy seem to have aborted the excess anterior-lobe pituitary function, and the condition appeared stabilized a year later.

Case 4. A. B., a man aged 60 years, in 1942 was subjected to severe overwork and strain in his business. After a year, he developed a fine tremor, and others noticed that his eyes were prominent, especially the right. In 1944, he came to Oxford (figs. 35, 36). His weight was 144 lbs., his pulse rate 72, and the B.M.R. +43. External ophthalmoplegia and proptosis were present.

A lateral tarsorrhaphy was performed, and the patient was treated with progynon. He improved slightly and gained 16 lbs., but a few months later broke down again and developed auricular fibrillation. The eye movements had recovered, and there was very little proptosis. Von Graefe's sign and lid retraction were marked, and his condition suggested excess thyroxine, with practically no pitui-



Figs. 35, 36 (Mann). Group III, Case 4, Mr. A. B., aged 60 years was photographed on August 30, 1944. B.M.R., +43. In Fig. 35 the patient exhibits the signs of pituitary exophthalmos and of thyrotoxicosis. There is edema of the lids (especially above the inner canthus of the upper lids); also lid retraction and limitation of movement. Fig. 36, same date, shows the right side and demonstrates the overhang of the upper lid coexisting with lid retraction and proptosis.

tary disturbance. His condition is at present being treated with thiouracil and digoxin, but is deteriorating, with marked cardiovascular signs.

The accompanying table summarizes these cases. It will be seen that in them all the signs of excess thyrotropic hormone are present, but that in group I the B.M.R. is consistently low; in group II it bears no constant relation to the eye condition and is extremely variable, although somewhat related to the performance of a thyroidectomy; whereas in group III it is consistently high. This would appear to bear out the contention that proptosis and ophthalmoplegia are not related to thyroxine excess.

The last column shows treatment and its effects. It is noteworthy that, in spite of Mulvany's contention that tarsor-

rhexy is useless in thyrotropic exophthalmos and that Naffziger's orbital decompression is indicated, all the cases in groups I and II have done well when treated with tarsorrhaphy and thyroid extract.

The patients in group III cannot be given thyroid extract and must be treated symptomatically, further work being necessary to decide the relative value of the various possible procedures.

CONCLUSION

It would appear that the signs of excess thyroxine include: loss of weight; rapid pulse; raised B.M.R.; soft, moist skin; lid retraction; and lid lag (von Graefe's sign), whereas those of anterior-lobe pituitary thyrotropic hormone consist of: orbital, lid, and conjunctival

TABLE 1
DATA ON 18 CASES OF EXOPHTHALMIC OPHTHALMOPLÉGIA

Groups	Case Number	Age	Sex	B.M.R.	Edema	Ophthalmoplegia	Thyroidectomy	Treatment	Result
I	1	54	F	-9	++	—	no	Thyr. Ext.	Cured
	2	54	F	-27	++	+	no	Thyr. Ext. and tarsorrhaphy	Improved
	3	57	M	-1	+++	+++	no	Thyr. Extr. and tarsorrhaphy	Cured
	4	47	F	?	++	++	yes	Tarsorrhaphy	Improved but died later with thymus tumor
II	1	44	F	+3	+	++	yes	Thyr. Ext. and tarsorrhaphy	Much improved
	2	47	M	-10	+	+	yes	Thyr. Ext.	Cured
	3	47	F	0	+++	+++	yes	Thyr. Ext. phenobarbitone and tarsorrhaphy	Much improved
	4	54	F	+58	+	+	yes (later)		Stationary
	5	56	F	+13	++	++	no	Aminophyllin and rest	Practically cured
	6	57	F	-4	++	+	yes	Thyr. Ext.	Improved
	7	60	M	+27	+	++	no	Tarsorrhaphy	Improved
	8	62	F	+2	+++	+++	yes	Thyr. Ext. and tarsorrhaphy	Practically cured
	9	71	F	+25	++	++	no	Phenobarbitone	Stationary
	10	76	F	-10	+	++	no	Thyr. Ext.	Improved
III	1	42	M	+10	++	+++	no	Tarsorrhaphy, progynon, Lugol's solution, Testosterone	Much improved
	2	53	M	+38	+++	+++	no	Tarsorrhaphy x-ray to pituitary	Much improved
	3	60	F	+32	+	+	not previous	Tarsorrhaphy and partial thyroidectomy	Cured
	4	60	M	+43	+	++	no	Tarsorrhaphy, progynon	Improved

edema and infiltration; hence—proptosis, ophthalmoplegia, fundus changes (papilledema, engorgement, macular exudate), lid edema, chemosis, eversion of conjunctiva—all of which may or may not be associated with deficiency of thyroxine. The latter will show itself as: low B.M.R., gain in weight, thick, coarse skin, and slow pulse.

Eighteen cases are described in an attempt to assess the various signs and

symptoms met with in so-called exophthalmic ophthalmoplegia.

My thanks are due to my colleagues and particularly to the following co-workers who have referred cases to me: Prof. H. Cairns, Prof. A. W. M. Ellis, Miss D. Beck, Mr. Dukes Bower, Dr. J. A. Fisher, Dr. A. Gillie, Mr. A. C. Houlton, Mr. G. Livingston, Mr. T. Negus, Dr. W. R. Playfair, and Dr. J. N. Wheeler.

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BELGIAN OPHTHALMOLOGY DURING THE WAR

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HISTORY

PERIOD OF OCCUPATION

The Germans invaded Belgium in August, 1939. In the general mobilization of troops to guard the border one ophthalmologist was attached to each Army Corps and one to each military hospital. It was not long, however, before the Nazis dissolved the Medical Corps and either sent the doctors to Germany as prisoners or distributed them to the Belgian Red Cross and other organizations. Only a handful of ophthalmologists remained in Belgium. In Liège, Prof. L. Weekers stayed to give his services to the Red Cross, which cared for wounded civilians and for Belgian, French, and German soldiers. In Brussels, the private eye clinic of Professor Coppez was absorbed into the Belgian Red Cross under the title of Auxiliary Hospital Number 138. Ocular injuries of both military and civilian personnel were treated. These consisted largely of contusions, perforations, and intraocular foreign bodies. Many were transferred to the Louvain University Hospital of St. Pierre, which was retained by the Belgians. The Brugmann Hospital in Brussels was taken over by the Germans. The Nazis attempted to dominate the Universities of Louvain and Brussels, but the Belgians resented their control to such an extent that all normal activity was virtually paralyzed. Despite these unfavorable conditions, efforts were made to continue teaching clandestinely, and, under the direction of Professor Coppez, ophthalmology was taught to scattered groups of students.

Although a small number of doctors coöperated and even collaborated with the enemy, as a group they conducted them-

selves in a praiseworthy manner. Doctors, nurses, and medical technicians were well represented in the underground movements. Scientific research was carried on despite rather discouraging conditions. After 1939, the Belgians no longer received British and American scientific journals, although French publications were allowed entry. The Swiss continued to publish "Ophthalmologica," but the journal failed to arrive. The *Acta Ophthalmologica* of the Scandinavian countries continued to appear regularly as did all the German periodicals. Because of the war, the articles were of a practical nature; that is, on the subjects of war surgery, intraocular foreign bodies, physiology, and special visual examinations for aviators. They also dealt with the development of substitute medications due to a lack of atropine, homatropine, pilocarpine, and eserine. Belgian physicians continued to write, and their articles appeared in Swiss and Scandinavian reviews and in their national periodicals. Publication of the *Bulletin of the Belgian Academy of Medicine* was prohibited after the first two years of the German Occupation. In Louvain, clinical and laboratory research was handicapped by the burning of 800,000 volumes. The lack of chemicals—for example, alcohol, benzine, xylol, and balsam—glassware, and specialized apparatus was a big handicap. Experimental animals were obtainable only at exorbitant prices, and it was virtually impossible to feed them without dealing in the black market. A study of the use of heparin in treatment of thrombosis of the retinal veins was interrupted because the drug could no longer be obtained. Despite all these drawbacks, a

number of research problems were successfully completed and the more important of these will be discussed.

PERIOD OF LIBERATION

The bombings, violent ground combat, and flying bombs which preceded and followed the Liberation (September, 1944) brought about a procession of the gravely wounded. Splinters of glass projected with violence by the explosions caused serious traumas to the eyes and faces of civilian victims. For example, there was the explosion of a train loaded with ammunition in the station of Marloie, a small village in the Ardennes. Following this catastrophe, 17 enucleations had to be performed because of grave ocular perforations. At the time of the liberation of Liège, the Germans sent three tanks loaded with dynamite into densely populated places, causing a great number of killed and wounded. There were about 30 people with severe eye injuries, the majority of which were caused by glass splinters.

Before the war, it was through the Belgian-American Education Foundation that the Belgians had learned much of American medicine. During the last year of the war a number of U. S. Army hospitals were set up in Belgium, and this gave the doctors of both countries a new point of contact for the interchange of literature and clinical experiences.

INFLUENCE OF THE WAR ON OCULAR DISEASES

DIET

Belgium is an overpopulated industrial country. Her population of 8,250,000 inhabitants, in an area of only 11,750 square miles, is the most crowded in Europe.

Obviously, such a country could not supply its food requirements from home produce. The deficit was made good by

imports from overseas, estimated to represent 70 percent of the calories contained in the normal Belgian diet. A scarcity of food was therefore inevitable within a few months of the German arrival. Instead of the 1,500 calories that every Belgian could receive from the food produced in the country, a theoretical official ration provided for only 1,200 calories in 1940, and 1,160 calories in 1942. And even these amounts were not obtained because the quantity of rations actually distributed was always less than the quantity officially prescribed. The rations distributed provided only 900 to 1,000 of the 2,400 calories required by an adult person.

The table on page 676 compares the basic foods available in Belgium before the war and at present. It should be noted that the values given refer only to articles of prime necessity, the only ones with which the great majority of Belgians can now be concerned, although before the war they consumed in addition a quantity of accessory products of high nutritive value.

The food scarcity shown by this table is attributed to Nazi pillage.

The figures given show that the food supply of the average Belgian was dangerously inadequate. It could only lead the adult to an early grave and permanently impair the health of children and adolescents.

Govaertz, Brull, and Dumont¹ studied the nutritional state and nitrogen balance of the adult population at the outset of the war. The 1,300- to 1,500-calorie diet resulted in an average weight loss of 12 percent among the clinic patients at Liège University. Even in those who were not thin, the plasma proteins dropped 10 to 20 percent and sometimes 50 percent. The protein deficit, made particularly acute by a low-calorie diet, is the basis for nutritional edema.

TABLE 1
COMPARATIVE TABLE OF BASIC FOODS

	Average daily consumption before the war	Country's productive capacity	Amount issued during the war
Bread	430 grams (15 oz.)	325 grams (11 oz.)	225 grams (8 oz.)
Potatoes	560 grams (1¼ lbs.)	1100 grams (2½ lbs.)	150 grams (5 oz.)
Meat	110 grams (Nearly 4 oz.)	98 grams (3. oz.)	24 grams (under 1 oz.)
Sugar	77 grams (2⅔ oz.)	100 grams (3½ oz.)	48 grams (1¼ oz.)
Butter & Fats	58 grams (2 oz.)	30 grams (1 oz.)	10 grams (⅓ oz.)
Starchy foods	8.3 grams (29/100 oz.)	6 grams (21/100 oz.)	1.65 grams (6/100 oz.)

OCULAR TUBERCULOSIS

Of all the maladies for which under-nourishment is a predisposing cause, tuberculosis is the most widespread. The rise in the incidence of this disease in Belgium has been alarming. After the first winter of Nazi domination, the urban antitubercular medical centers reported a 30-percent increase in incidence. The mortality rate doubled after the first winter and trebled by the end of the second winter.

Ocular manifestations of tuberculosis were correspondingly more frequent. Iritis and iridocyclitis are particularly important because they occurred most commonly. Scleritis, sclerokeratitis, chorioiditis, retinal periphlebitis, and phlyctenular keratoconjunctivitis were also on the increase.

L. Weekers² pointed out that with rare exception ocular tuberculosis is endogenous in origin; it is secondary to an active or healed pulmonary focus. As in surgical tuberculosis, ocular cases are infrequent in advanced phthisis. Wegner³ reported three cases of ocular tuberculosis without general manifestations, and

was able to prove the etiology only at section. One of the cases he cites is the following: A woman, aged 27 years, developed bilateral iridocyclitis with retinal involvement in one eye. The local signs were those of tuberculosis, but there were no other clinical findings in support of this etiology. Her general health was at first unimpaired, later she developed a low-grade fever. She was kept under observation and treatment for several months. Her local and general condition grew worse, and the etiology remained unproved. The internist did not believe that she had tuberculosis. She died in uremia. Autopsy revealed caseous and calcareous lesions in the tracheobronchial lymph nodes. The mesenteric nodes also showed advanced caseation necrosis. Tubercles were present in the liver, and amyloid degeneration was found in the kidneys.

Schmidt⁴ reported two cases of retinal periphlebitis due to the tubercle bacillus. Here again the patients were observed for several months, but the diagnosis of tuberculosis could not be proved clinically. Necropsy alone disclosed advanced tuberculosis of the lymphatic system.

Fanielle⁵ reports encouraging results in the treatment of these forms of tuberculosis with massive doses of vitamin D (15 mg. given over an 8-day period) and calcium glycono-phosphate (5 to 20 gm. daily).

NUTRITIONAL EDEMA

During the winters of 1940, 1941, and 1942 there were a number of patients with generalized edema. They were undernourished and their diets were particularly low in protein. The syndrome was termed edema of carence.

R. Weekers⁶ studied the ocular symptoms in 15 patients who had this type of edema. Unlike the cases of Birch-Hirschfeld, they did not have hemeralopia. Despite a reduction in plasma proteins and a lowering of the albumen-globulin ratio the intraocular pressure was normal or, more often, low. These observations run contrary to the theory which states that the aqueous humour is a simple dialysate, the formation of which is regulated by the laws of osmosis.

HEMERALOPIA

In recent years, considerable work has been done on the appearance of night blindness due to undernutrition, notably inadequate intake of vitamin A. This concept is not universally accepted. Clemens⁷⁻¹⁰ and his co-workers compared dark-adaptation curves with the storage of vitamins A, B, and C in the body. The subjects were first exposed to bright light for 10 minutes, and then curves were plotted for 38 minutes or until they reached the plateau of maximum dark adaptation.

Clemens used the photoadaptometer with Birch-Hirschfeld filters.* Vitamin-

A dosage was measured by its effect on the blood serum by the method of Von Eekelen and Emmerie, using the reaction of Carr and Price. Patients complaining of night blindness, asthenopia, and glare showed curves that were at the lower limit of normal. In cases with normal vitamin-A blood levels, deficient diet was not considered the cause of the asthenopia. Owing to the variable readings in the same subjects and in different normal subjects, the normal adaptation curve was necessarily a wide band (No. 3-5 Birch-Hirschfeld filters) with upper and lower limits. Recovery rate, either at the beginning or end of adaptation, is not proportional to vitamin-A blood level. However, those with high levels did show a sharper rise. After giving 150,000 U.S.P. units of vitamin A daily for two weeks, the curves remained unchanged. In group studies the curves of 50 students taken at the end of the winter of 1942 were comparable to those of 50 others taken in the spring of 1941. The mean vitamin-A level was 8.5 gamma/10 c.c., and 7.9 gamma/10 c.c., respectively. During the war period 1941 to 1943 Clemens did not discover any case of hemeralopia due to undernutrition. He concluded that dark adaptation was a poor test for hypovitaminemia A.

There is no correlation between vitamin-B saturation in the urine and speed of dark adaptation. Similarly, no relationship exists between the degree of adaptation in any part of the curve and the level of vitamin C in the blood. In subjects whose blood vitamin C was definitely low (less than 2.0 mg.) dark adaptation remained normal.†

* Time is recorded on the abscissa of the graph and on the ordinate the numbers of the graded filters are placed. According to Zaffke, filter No. 12 corresponds to 13 millilux, and filter No. 19 to 0.1 millilux.

† The level of vitamin C was determined by the method of Emmeraux and Van Eekelen and varied from 0.97 to 16.5 mg. per liter. The average was 3.7 mg.

KERATOCONJUNCTIVITIS

Coppez¹¹ observed an increase of one type of this disease during the war. It begins with a severe conjunctivitis and secondarily involves the anterior portion of the cornea, where it produces characteristic round lesions. Since it appears epidemically in the same season as upper-respiratory infections, this form of keratitis is probably due to a virus. The disease is rare in children. Binocular involvement is uncommon. Mechanical or chemical irritation acts as a predisposing cause. The treatment is conservative, and if the conjunctivitis is treated effectively, long and severe corneal complications are avoided. Although the prognosis is good and there is no systemic involvement, patients are incapacitated for one or two weeks.

OPTIC NEURITIS DUE TO NICOTINE

In all parts of Belgium, a striking increase in this disease was noted. L. Weekers and P. Joiris¹² at the University of Liège stated that the proportion of these cases compared to the total number of ocular affections was 0.07 percent before the war and in 1942, 0.33 percent. This fact helps to clarify the pathogenesis of the disease. Alcohol is excluded as a cause because it was almost unobtainable, even at exorbitant prices. In contrast, tobacco was available in quantity. The action of the tobacco toxin is considerably enhanced by undernutrition. Only the aged were affected, the average being 59 years, and without exception all were considerably underweight (average 11 kg.). Weekers and Joiris believe that tobacco, alcohol, and poor health are the factors which in different combinations lead to retrobulbar neuritis. Tobacco is the only one of the three which alone may cause the disease. Poor general health and chronic alcoholism either alone or together will not produce retrobulbar neuritis, but they are important predisposing

causes. General body weakness, regardless of the cause, favors the toxic action of tobacco on the optic nerve and the retina, and alcohol lowers both local and general resistance of the body. The authors suggest that this disease be called nicotinic neuritis and not tobacco-alcohol neuritis, because the tobacco toxin is the only specific cause.

PUBLICATIONS DURING THE WAR

CORNEA

Appelmans and Gathy¹³ described the lesions caused by the projections of the caterpillar against the eye. The disease is divided into two phases. In the first of these, the eyelids and bulbar conjunctiva are involved, due to the vesicant action of the venom carried in the hairs. It is characterized by subjective complaints such as diminishing vision, pain, photophobia, lacrimation, and active inflammation with pericorneal injection, corneal edema with vesicles, and superficial ulcerations. This acute reaction subsides as the action of the toxin diminishes. The second phase is a chronic process resulting from the presence of hairs as foreign bodies. Photophobia and ciliary injection are absent, and the visual acuity improves. The hairs excite the formation of absorption bodies, which are identified under the slitlamp as nodular opacities in the corneal stroma.

L. Weekers and R. Weekers¹⁴ treat severe painful ulcers of the cornea by retrobulbar injection of 1 c.c. of 40-percent ethyl alcohol after anesthetizing the tissues with procaine. They also use minimal amounts of heat generated in the tissues by contact with a diathermy needle. They state that this procedure is the treatment of choice and should be tried early.

Van Lint¹⁵ treats ulcers of the cornea by retrobulbar injection of procaine in addition to the topical application of tincture of iodine.

LENS

R. Weekers¹⁶ investigated the chemistry and metabolism of the lens. Depending on the concentrations used, perhydro (hydrogen peroxide 30 percent) and sodium iodate inhibit or retard the glucose consumption of an aqueous extract of the lens. Whether this is by direct or indirect action is unknown. Sodium iodate causes opacification of a lens isolated *in vitro*. This results from the arrest of carbohydrate metabolism due to a direct toxic action of the oxidizing agent on the protein of the lens cortex.¹⁷⁻²⁰

In the course of naphthaline poisoning, carbohydrate metabolism is retarded. The slitlamp shows the first opacities of the lens before glucose consumption is increased or decreased. Therefore the arrest of glycolysis cannot be considered as a cause of cataract.²¹

In the rat, ingestion of galactose produces severe polydipsia and polyuria, with an increased output of calcium in the urine and a reduction in the blood calcium. This effect is more pronounced in the young animal than in the adult. A relationship exists between the appearance of the hypocalcemia and the opacification of the lens. However, hypocalcemia is probably only one of the factors in the formation of cataract due to ingestion of galactose.²²⁻²⁵

In diabetic patients it is somewhat common to see moderate transitory hypermetropia following a reduction of carbohydrate in the diet or following insulin treatment. This hypermetropia is due to lens changes.²⁶

R. Weekers²⁷ studied nine cases of cataract due to hypocalcemia. Seven of these followed thyroidectomy with parathyroidectomy, and two resulted from idiopathic tetany. By elevating the blood calcium to a normal level with vitamin D and calcium salts, the author was able in

favorable cases to prevent the formation of cataract and even to bring about a recession of beginning cataractous changes.

François²⁸ studied the influence of immunologic factors on the production of congenital lens opacities. The injection of lens protein in animals produces specific precipitins which can be differentiated from other animal proteins. There are two types of soluble protein in the lens, A and B. They are immunologically different and are organ but not specie specific. Fraction A is immunologically active in the homologous animal.

The total lens protein and the B fraction do not produce antibodies when injected into a homologous animal but do when injected into a heterologous animal. On the contrary, fraction A produces specific precipitins in both instances. François in his first series of experiments injected rabbits with lens emulsion and confirmed the antigenic properties of lens proteins and their specific character. The liberation of lens fragments by discission, however, does not produce an appreciable concentration of precipitins and the animal is incapable of hypersensitization to its own lens protein. The author was unable to demonstrate antilens precipitins in patients with cataracts either before or after cataract extraction. The intradermal reaction to lens protein in normal individuals and in patients with cataracts before and after operation shows evidence in certain cases of skin hypersensitivity, but is not of diagnostic or prognostic value.

In another series of experiments the author produced congenital cataract immunologically. To obtain this effect he injected pregnant rabbits with lens emulsion. About half of the litter had lens opacities. If the injections were done six weeks before conception rather than during pregnancy, 64 percent of the young showed lens opacities. These opacities

were bilateral and did not change during the subsequent development of the animal. They were often so small that it was possible to see them only under a biomicroscope. From this series of interesting experiments, the author concluded that these congenital cataracts must be due to an immunologic phenomenon in which the appearance of cataract is due to the fact that during fetal life the vascular capsule of the lens permits antibodies to enter into direct contact with lens antigen but after birth the lens is impermeable to antibodies.

L. Weekers²⁹ describes a technique for fenestration of the posterior lens capsule in cataract extraction. It consists in tearing the posterior capsule of the lens with a minute iris hook after extracapsular extraction of the cataract. The procedure is considered safer than intracapsular extraction, and the functional results are excellent.

UVEA

Harada's disease³⁰ is rare in Europe, but in the Far East, especially in Japan, it is endemic. The authors made a table of all the characteristic symptoms as follows: (1) Ocular signs consisting of bilateral uveitis with retinal detachment. (2) Neurologic signs consisting of increased intracranial pressure with lymphocytes in the spinal fluid, vertigo, insomnia, and loss of hearing. (3) Changes in the pilous system, graying of the hair, baldness, and sometimes vitiligo. It behaves like an infectious disease due to a special uveo-neurotropic virus related to that of sympathetic ophthalmia. Pirot and Heintz related observations they made on two cases, the first ones to be reported in Belgium. These patients presented classical symptoms, but the course of the disease was accelerated and resulted in rapid loss of vision. In the first case, the onset was sudden, with frontal headaches of

such intensity that repeated lumbar punctures were necessary for relief. The uveitis was total and so severe that it resulted in complete loss of vision and atrophy of the globe. The second case was slow in onset, and the inflammatory process resolved after eight months, but two serious complications occurred bilaterally; namely, glaucoma secondary to seclusion of the pupil, and cataract. No specific therapy is known.

RETINA

Röskam, Kilgus, and Bonhomme³¹ reported a case of cerebral and retinal thrombosis treated with heparin. This drug prolongs bleeding time considerably and so its use in cases of bleeding from important vessels—that is, cerebral hemorrhage—is contraindicated. Before heparin is given the diagnosis of cerebral thrombosis must be firmly established. This is sometimes possible, as in the present case, by finding coincident thrombosis of the retinal veins. The authors believe that the heparin treatment is effective in cerebral and retinal thrombosis, and they anticipate its use in thrombosis elsewhere; for example, in the heart. Heparin was injected intravenously in the following doses: 150 mg. twice a day for the first 3 days; 100 mg. twice a day for the next 19 days; 75 mg. twice a day for the next 20 days.

Appelmans³² describes the various causes of retinal hemorrhage. He stresses essential hypertension and states that simple retinal hemorrhage does not have the grave prognosis of the angiospastic retinopathy of Volhard, in which 85 percent of the patients affected die within two years following the appearance of hemorrhage.

Coppez³³ was the first to discover the use of the pyrometric electrode in the treatment of retinal detachment. This electrode permits the exact measurement of

the temperature of the tissues at the point of application. At any moment it may be read on the dial of the pyrometer. The reactions obtained correspond identically with the reading. The electrode is based on the thermocouple principle, being a combination of a surface electrode and a thermometer. Coppez has shown that the surface area of the electrode, the duration of application, and the temperature are essential factors in the ultimate result. Optimum conditions are a surface 2.5 mm. in diameter, and 20 seconds of application at a temperature of 80°C. Operative technique: Coppez withdraws the active electrode from a tube of trioxymethylene and then applies it flatly on a well-dried and denuded scleral surface at the level of the tear. He checks the site of the first coagulation area in relation to the tear. It appears as a white spot with blurred margins. The tear is then sealed off and obliterated by a number of coagulations. The subretinal fluid is then evacuated by means of several perforations made at the level of the surface coagulation with a 1.5-mm. electrode. Sixty percent of all the cases and 80 percent of all those considered favorable were cured by this method. Coppez concludes his paper with a discussion of pathogenicity and states that detachment of the retina is secondary to a vascular lesion.

ANGIOSCOTOMETRY

After reviewing the work of John Evans, Weekers and co-workers³⁷ studied the subject rather intensively. They devised a technique for recording physiologic angioscotomas on the Bjerrum screen placed at a distance of one meter from the eye. They describe their method in detail.

Following a study of a comparison of the retinal vessels in fundus photographs with angioscotomas, they reached the following conclusions:

1. The recording of physiologic angioscotomas is easier and more exact when the lighting for the screen is less than 3 lux.

2. The optimum speed of movement of the test object is one degree every two seconds.

3. The optimum diameter of the test object varies with the degree of lighting for the screen and the caliber of the vessels studied.

4. The size of an angioscotoma is a little larger than a projection of a photograph of the corresponding retinal vessel on a visual-field chart.

5. The density of the angioscotomas is greatest centrally and decreases towards the periphery.

6. In favorable cases it is possible to distinguish arterial from venous angioscotomas.

7. The origin of pathologic angioscotomas appearing in the course of ocular or general disease remains hypothetical and requires further study.

Weekers³⁹⁻⁴⁰ found angioscotometric changes in cases of posttraumatic cerebral syndrome; namely, pathologic enlargement of the scotomas and an increase in their density. There is often a corresponding reduction in visual acuity and retinal asthenopia. These scotometric abnormalities probably result from a change in the conduction of impulses through the retinal neurons and synapses, which, in turn, seems to be due to disturbed circulation in the central retinal vessels.

GLAUCOMA

According to R. Weekers⁴¹ chronic simple glaucoma is accompanied by vascular lesions in the uvea, retina, and optic nerve. They give rise to the three cardinal symptoms of the disease; namely, ocular hypertension, visual-field defects, and excavation of the optic papilla. These three signs usually coexist, but in some

cases the hypertension is absent. One may then ask, should patients with optic-nerve atrophy, excavation of disc, and atypical visual-field changes be designated glaucomatous? Weekers,⁴² in another publication, describes a disease consisting solely in pallor of the disc with typical glaucomatous excavation but without any other anatomic changes. Retinal function is intact. The disease is acquired and is observed in middle and older-age groups, particularly in patients with advanced arteriosclerosis. The progress of the disease is very slow. In time, defects in the visual field and ocular hypertension may supervene. This suggests that the original optic-nerve lesion is related to glaucoma.

L. Weekers and R. Weekers⁴³ made a histologic and biomicroscopic study of two human eyes and the eyes of several cats on which microcoagulation of the ciliary body was performed. The authors conclude that all surgical operations for relief of glaucoma are by their very nature traumatic. All produce a change in the intraocular vascular circulation and a new equilibrium between aqueous and blood of varying duration. Intraocular pressure is decreased. Surgery is specific in that it affects the anterior uvea, the seat of formation of the aqueous. Diathermy of the ciliary body produces maximum damage to the aqueous-forming structures with minimum trauma and without opening the globe, thereby lessening the danger of postoperative infection.

All operations for chronic glaucoma create persistent vasodilatation in the uvea, especially in the ciliary body. This results in increased absorption of aqueous humor. As a late effect, a variable degree of atrophy of the ciliary body occurs and contributes to the hypotensive effect by decreasing production of the aqueous. L. Weekers and R. Weekers say that the cyclodiathermy operation without penetration or perforation of the sclera ac-

complishes this effect. The operation is indicated in secondary and absolute glaucoma. Coppez also describes an operation for glaucoma in which he uses diathermocoagulation with his pyrometric electrode. This is a modification of Vogt's technique.

MISCELLANEOUS

Coppez⁴⁴ reviewed the eye signs and symptoms in posttraumatic cerebral syndrome. Among the subjective symptoms the author emphasizes vertigo, headache, and psychical asthenopia. The functional symptoms, such as decrease in visual acuity and narrowing of the field of vision, the exact character of which is not always known, are considered less important. Great importance, however, is attached to the objective symptoms, namely:

1. The lability of the pressure in the retinal arteries and the disproportion to the brachial pressure. (These disturbances in the circulation are the expression of similar circulatory disturbances in the brain and have no relation to the cerebrospinal-fluid pressure.)
2. The retinal hypertension is characterized by the narrowing of the caliber of the vessels. Another somewhat frequent sign is the peripapillary edema, generally localized in the nasal sector of the optic disc.

Coppez⁴⁵ reported a case of bilateral hysterical blindness cured by convulsotherapy. The healing mechanism is not to be explained by the feelings of fear and of death set up by the injection of pentamethylentetrazol, but by the release of the blocking of intracortical association paths as seen from the electro encephalograms, and also by the severe disturbances of the cerebral circulation as shown by the measurement of the retinal-arterial blood pressure.

Appelmans and Van den Berghe,⁴⁶ in a paper on the ocular lesions associated with pellagroid dermatosis, reported a

case in which the cutaneous manifestations of pellagra were coupled with the ocular changes of ariboflavinosis. In each of three exacerbations, the ocular and cutaneous lesions coexisted. The patient presented a marginal arcuate opacity with conjunctival injection and bilateral superficial punctate keratitis. Iritis was limited to the left eye, and there was considerable photophobia and reduction in vision. The cutaneous lesions were typical of pellagra. Since adequate dosage of nicotinic acid and riboflavin did not result in specific cure, the author concluded that this was not pellagra.

Appelmans and Lams⁴⁷ described the

macroscopic and microscopic lesions found in the eyes and optic nerves of dogs inoculated with *Trypanosoma marocanum* as follows: 1. Nonsuppurative interstitial keratitis with several foci of scleritis and episcleritis without ulceration. 2. Acute suppurative iritis followed by chronic iridocyclitis and disseminated choroiditis. The retina remained normal. 3. All of the ocular media were cloudy. The lens showed degenerative lesions which progressed to total cataract. 4. Optic neuritis and perineuritis.

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OXYCEPHALY ASSOCIATED WITH KLIPPEL-FEIL SYNDROME AND OTHER SKELETAL DEFECTS

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Oxycephaly is a congenital malformation of the skull of unknown etiology but probably developmental in origin which has been thoroughly studied and reported upon, especially in the various ophthalmologic and neurologic journals. Recent textbooks on neurology devote impressive amounts of space to this congenital deformity.

The following four cases are presented because they were noted in soldiers who had been recently inducted into the Service, and who had only mild or moderate changes associated with this condition. They are being reported primarily to demonstrate the fact that this condition will exist in mild forms, producing variable symptoms which may go undiscovered for extended periods of time.

Oxycephaly is of interest to the ophthalmologist because the majority of the patients exhibiting this condition present numerous ocular findings. The most common ocular symptom is that of exophthalmos. This varies from a mild degree to extreme proptosis and extrusion of the globe. Ptosis is frequently seen, as is an inability to close the lids completely. The exophthalmos probably is secondary to the very shallow orbits, so that there is insufficient room for the globe and the surrounding soft tissues.

Next in frequency in the common eye findings is strabismus. This is usually of the divergent type, although a few cases have been reported showing a convergent squint. Frequently, also, there is a weakened, or loss of, convergence.

A further eye finding is nystagmus of the ocular type. It is probably secondary to the strabismus and poor vision which exists in these conditions.

Impairment of vision is usually present to some degree. It frequently is more marked in one eye than in the other. The loss of vision is due to optic atrophy of the secondary type, although cases have been reported in which this has not always occurred. Three of the four cases presented here show mild degrees of atrophy that cannot be classified on a secondary basis.

There is a difference of opinion as to the exact cause of the atrophy. Davis¹ thought that it resulted from a narrowing of the optic foramen. Greig² believed that a malformation of the middle fossa and a consequent stretching and pulling of the optic nerve produced the changes. Increased intracranial tension, stenosis of various foramina transmitting blood vessels, and abnormalities of the internal carotid artery resulting in compression of the optic nerve have also been advanced as possible causes for the nerve palsy.

Abeles³ reported a number of cases of oxycephaly showing medullated nerve fibers, in which the pupils were widely dilated; none of my four cases, however, demonstrated this condition.

The most striking physical finding is the skull deformity, which may vary from a merely tall head to the more typical "tower skull." The skull is short in its anterior-posterior diameter; the forehead is high, with an associated widening or bulging of the temporal fossae. The orbits are usually shallow; supraciliary ridges may be absent or only faintly marked. The cheek bones are flattened, and there is frequently prognathism and a high narrow palatine arch. Occasionally marked septal deflection is present.

The X-ray findings are diagnostic, the

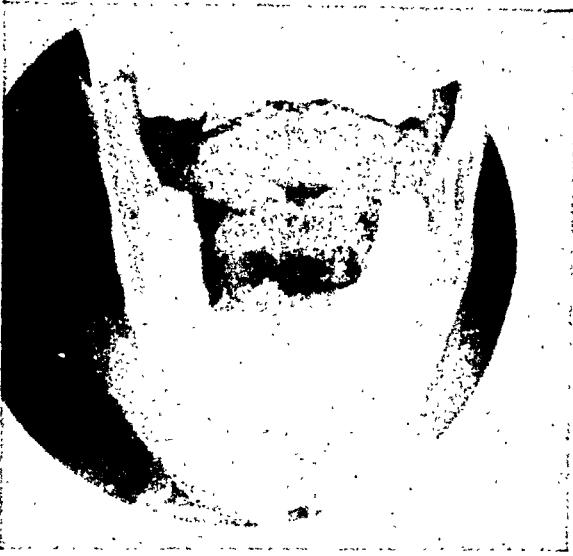


Fig. 1 (Peter). Klippel-Feil syndrome coalescence of cervical vertebra (case 1).

most striking feature being the appearance of the bones of the calvarium. They appear extremely thin and pitted all over with shallow depressions on their inner surfaces, said to correspond with the underlying convolutions of the brain but often more circinate and regular than these. They are known as digital impres-

sions. The vessels are exaggerated. The suture lines are obliterated. The orbits are shallow and there may be a definite protrusion of the brain as a result of an actual break of the skull. The anterior fontanels may remain widely open. The middle fossa is frequently pushed down to the level of the posterior fossa, and the anterior fossa is shortened and distorted.

Oxycephaly, as a rule, is associated with other congenital or developmental defects, and the four cases presented below are no exception. Among the various other defects present in these cases are: Brevicollis (or Klippel-Feil⁴ syndrome), patent parietal foramina, arachnodactylism, congenital deformities of toes, and other spinal-column defects.

The first case demonstrates brevicollis and also patent parietal foramina.

Brevicollis or Klippel-Feil syndrome consists of an absence of cervical vertebrae, and the following conditions are usually present. There is ordinarily a short neck and a low posterior hair line, with

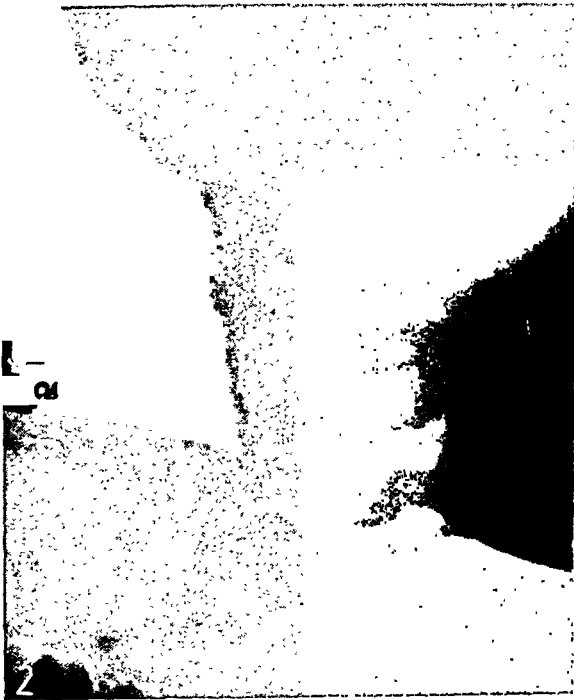


Fig. 2. (Peter). Lateral view showing fusion of bodies and processes of cervical vertebrae (case 1).
Fig. 3. Patent bilateral parietal foramina and tower skull (case 1).

limitation of head movement. Roentgenograms show vertebral reduction and coalescence in the cervical spine. The X-ray observations of this syndrome have been described by Rechtman and Horwitz⁵ (figs. 1, 2).

The parietal bone, bilaterally near the upper posterior angle, normally exhibits a minute opening through which passes an emissary vein. This opening is the parietal foramen. It may be absent, or, although faintly present, may be closed. Occasionally, it is doubled. The abnormally large foramina probably result from an irregularity in the process of ossification at the closure of the related fontanel (D. Greig⁶). The first case presented below demonstrated patent bilateral parietal foramina, and Klippel-Feil syndrome (figs. 3, 4).

The remaining three cases show spinal-column defects and deformities of the fingers and toes.

CASE REPORTS

CASE 1. A colored man, aged 22 years, gave an essentially negative family history. His father had died when the patient was nine years old, and had been blind in one eye. The mother and seven

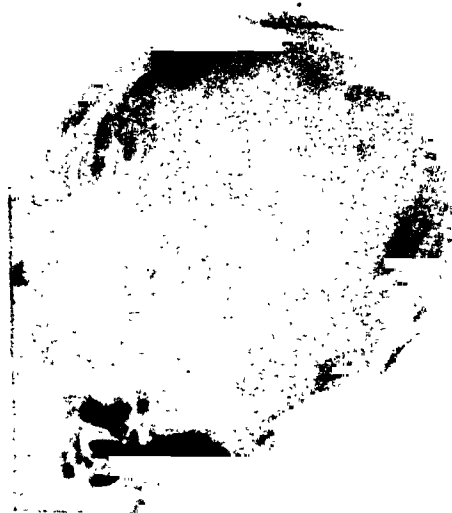


Fig. 4 (Peter). Skull showing high forehead, digital impressions, and no suture lines.



Fig. 5 (Peter). Note tower skull, short neck, low posterior hairline.

brothers and sisters were living and well, wore no glasses. The patient was the fifth and had been normally delivered. No defects in the siblings could be determined. The patient himself had had no operations nor illnesses and denied all venereal diseases. His present chief complaint was headache, swelling of the eyes, and, since entering the Service, inability to wear a helmet.

Examination. The patient was not acutely ill. **Head.** He had a definite skull deformity—dome-shaped, with decreased anterior-posterior diameter (fig. 5). The forehead was high. Palpation of the skull in the region of the parietal foramina revealed large defects bilaterally. Pulsation could be obtained on motion of the head forward and to the dependent position; no pulsation at any other point in the skull (fig. 6).

Eyes. Vision was O.U. 20/20. There was a slight bilateral ptosis. Pupillary reactions were normal. Exophthalmos was 19 mm. O.U.; tension 15 mm. Hg (Schiötz) O.U. There was exotropia

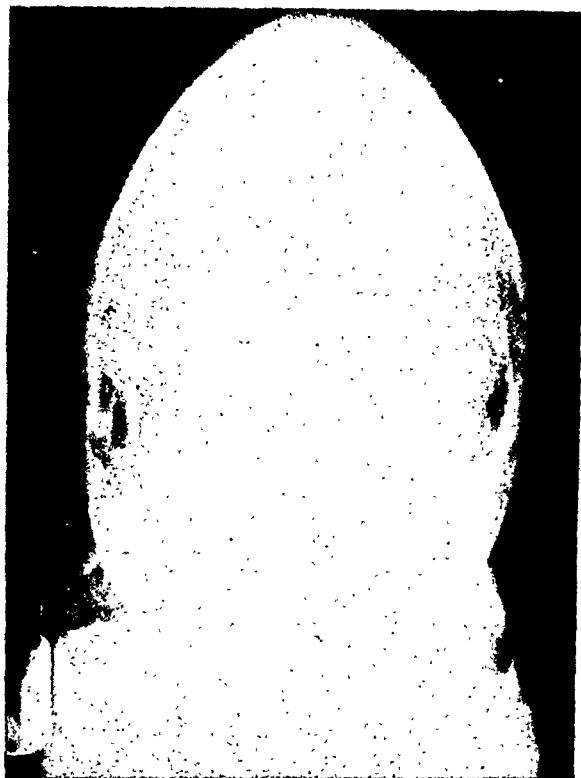


Fig. 6 (Peter). X-ray view showing tower skull.

for distance and near. Convergence near point measured 14 cm.; accommodation 9 P.D., O.U. The media were clear, the fundi negative, except for the nerve head, which was slightly pale for this race. The vessels appeared to be normal. There was no evidence of previous inflammatory reaction. Visual fields showed a moderate concentric contraction for form. The color vision was normal.

Ears. Ear canals and drums were normal. Hearing to whispered voice, 15/15 A.U. The audiogram showed a bilateral mild type of perceptive deafness. *Nose.* The septum was folded and deviated to the right. The nasal mucosa was normal; there was no discharge. *Throat.* Observed were a high narrow palate; small, cryptic tonsils with a slight amount of chronic

infection. In relation to the Klippel-Feil syndrome the folded septum and high palate are interesting. The patient gave no history of nose injury.

The neck was short, with hairline extending lower than is usually seen. There was slight limitation of motion of the head but without pain (see X-ray reports). Both hands showed lateral deviation of fifth fingers. The remainder of the physical examination was essentially negative.

X-ray studies. There was a congenital anomaly of the skull which revealed evidence of a turrecephaly, a form of craniostenosis. Two well-defined areas of radiolucency, equidistant from the sagittal plane of the skull, were situated in the posterior portion of the parietal bone, each equal in size and measuring approximately 2.5 cm. in diameter. These areas were due to the enlarged parietal foramina. The cervical spine showed almost complete fusion of the bodies of the third and fourth cervical vertebrae, as well as their posterior articular appendages. The axis was asymmetrical in appearance, and there was a protrusion extending from the lateral masses' right side, which



Fig. 7 (Peter). Lateral deviations of fifth fingers' distal portions.

formed a joint space with another portion of bone that appeared to descend from the right side of the atlas. The dorsal spine revealed a *spina bifida occulta* of the first dorsal vertebra. There was almost complete sacralization of the transverse processes of the 6th lumbar vertebra. Both hands showed congenital anomalies of the distal portions of the fifth fingers, which were deviated laterally (fig. 7).

Laboratory. All tests, including the Kahn, were negative.

CASE 2. A colored man, aged 20 years, 5 ft. 7 in. in height, weight 145 lbs.; showed a definitely high head with high forehead, symmetrical. The skull was dome-shaped or a typical tower skull (fig. 8).

His father and mother were living and well; he was the fifth of nine children (three brothers and five sisters), living and well. All members of family were of apparently normal mentality, there were no congenital deformities. The patient had finished the eighth grade. He had had no illnesses of any kind, as far as he knew; no operation, except tonsillectomy at the age 12 years; and he denied all venereal diseases.

For as long as he could remember he had had trouble with his eyes, consisting primarily of pain and swelling of eyes. He also complained of headache, but his chief difficulty since entering the Service had been inability to wear a helmet.

Examination. The eyes. Vision O.U. was 20/20. There were a bilateral, mild ptosis and exophthalmos: O.D. 19 mm.; O.S. 21 mm. Exotropia was present for distance and near. Accommodation, O.U. 7.5—8.5 PD.; Pcb., 10 cm. Pupillary reactions were normal, the pupils normal in size. The anterior segments were normal. The discs were both slightly pale, that of the left eye showing on the nasal



Fig. 8 (Peter). Showing side view of head (case 2).

side a large amount of fibrous tissue. The visual fields for form showed a moderate concentric contraction. Color vision was normal. Tension O.D. and O.S. 14 mm. Hg (Schiotz).

Ear, Nose, and Throat. The patient complained of difficulty in breathing through his nose, alternating in character for as long as he could remember. Ear drums and canals were normal. Hearing to whispered voice was 14/15 A.U. The audiogram revealed a moderate amount of bilateral nerve-type defective hearing. The septum of the nose was straight, the nasal mucosa congested, particularly on the right. There was no discharge. The palate arch was moderately high, there were malocclusion and bilateral, small tonsillar tags.

The neck, somewhat short, was otherwise negative.



Fig. 9 (Peter). Lateral view of skull, showing absent suture lines, thinning of cortex, and increased digital markings (case 2).

The thorax showed curvature of the dorsal spine, mild kyphosis, and lateral curvature, with apex to the left between the scapulas. There was asymmetry of the thoracic cage.

Blood pressure was 118/80.

The hands and feet showed lateral de-

viations of the fifth fingers, bilateral and lateral obliterations of the toes.

X-ray studies. Examination of the skull revealed obliteration of the suture lines of the frontal parietal sutures; there was some thinning of the cortex of the frontal bones; the digital markings corresponding to the convulsions of the brain were accentuated. The anterior fossa appeared slightly elevated when compared with the normal skull and there was some elevation of the vertical diameter of the skull as compared to the transverse diameter. The dorsal spine revealed a scoliosis of the upper dorsal vertebrae, with the convexity to the right (figs. 9, 10, 11).

Orthopedic consultation found a curvature of the dorsal spine, mild kyphosis, and lateral curvature with apex to the left between the scapulas. X-ray studies showed a gross deformity, apparently a narrowing and loss of substance with fusion of the 3d, 4th, and 5th dorsal vertebrae; Sharp posterior and left lateral bowing at this point. Diagnosis: Deformity of the spine, 3d, 4th and 5th dorsal vertebrae,



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Fig. 10 (Peter). Elevation of vertical diameter of skull (tower skull).
Fig. 11. Deformity of spine, dorsal vertebrae.

blood studies were essentially negative.

Laboratory reports of the urine and with fusion and angulation, congenital. Blood Kahn and Wassermann reactions were negative. No spinal-fluid examination was made.

CASE 3. A colored man, aged 26 years, was apparently not acutely ill (fig. 12). His chief complaint was impaired vision, left eye, and inability to wear a helmet. His father, living and well, had a short second toe on the left foot. The mother, dead, of a cause unknown, had had long fingers. He had one sister, living and well, and two half-brothers, well. There was no history of impaired vision or skull deformity in the immediate family. The patient had finished high school and three years of architectural drawing.

At the age of 14 years he had been struck with a ball, with injury to the left eye. Headaches were severe up to the age



Fig. 12 (Peter). Oxycephaly in case 3.

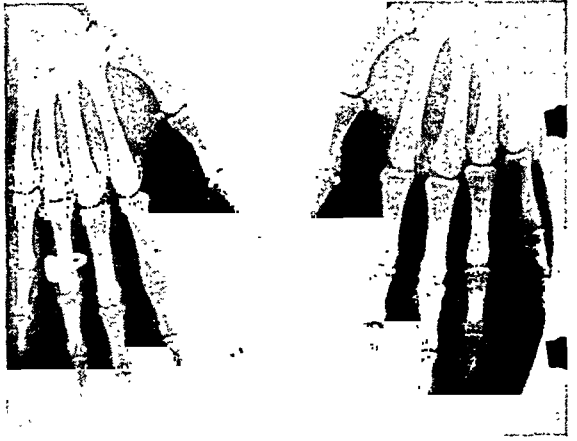


Fig. 13 (Peter). Arachnodactyly of fingers (case 3).

of 17 years, since then only rare.

Examination. Head. There was a definite skull deformity with narrowing of the anterior-posterior diameters, high forehead, and slight bulging at the temporal fossa. No pulsations were noted anywhere.

Eyes. Vision was O.D. 20/20; O.S., light projection. There was bilateral exophthalmos of 20 mm. Convergence near point was 15 cm.; the accommodation O.U. 8-10 PD. The pupils were normal in size and reactions. There was ocular nystagmus on extreme lateral gaze. Pigment was deposited on the anterior lens capsule, bilaterally; the vitreous of the right eye was negative; in the left eye there were many fine opacities, granular and pigmented. The disc of the right eye was negative; that of the left, pale, with marked fibrosis of the vessels leaving the disc, and also in periphery. In the macular area was a large, healed area of chorioretinitis, with a vertical choroidal tear, temporal to the macula. The visual field of this eye showed marked contraction for form; that of the right, moderate contraction. Tension O.U., was 21 mm. (Schiotz).

The fingers were somewhat long, tapering, and spiderlike (fig. 13). A deformity of the second toe of the left foot suggested absence of the middle phalanx

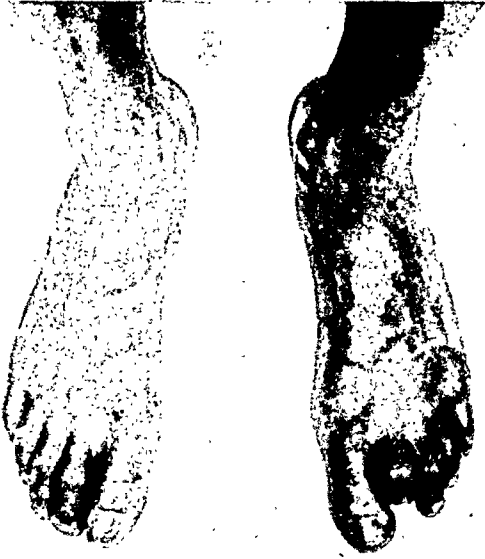


Fig. 14 (Peter). Congenital deformity of second toe, left foot (case 3).

(figs. 14, 15). The remainder of the physical examination and laboratory studies, including blood Kahn test, was essentially negative.

X-ray studies. The skull was congenitally deformed as to shape and increased in height (fig. 16). There were obliteration of the coronal suture, due to its premature



Fig. 15 (Peter). X-ray view of deformed toe (case 3).

closure, and an increase of the digital markings in the inner table of the skull. The anterior fossa was high in position; the posterior fossa, low and elongated, occupied at least one half of the base of the skull; the middle fossa was small in appearance. Both hands presented a tendency to arachnodactyly, manifested by elongated and thin phalanges, especially the distal phalanges; both feet had a hallux-valgus deformity. The middle and dis-

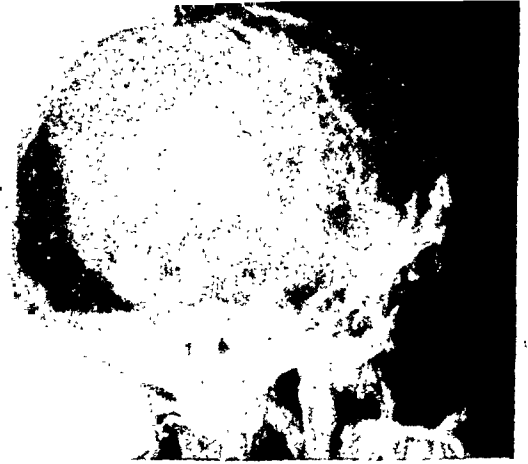


Fig. 16 (Peter). Absent suture lines, increased digital markings (case 3).

tal phalanges of the left second toe were small in size. The lateral view of the right foot revealed a narrowing of the antero-posterior diameter of the proximal portion of the phalanx of the third toe. These were congenital deformities.

CASE 4. The fourth case was not completely studied owing to the fact that the individual left our jurisdiction before the work-up could be completed. His chief complaint was headache, difficulty in wearing a helmet, and poor vision. The family history was not obtainable. The head showed a definite deformity, with a high forehead and narrow antero-posterior diameter, a typical tower shape.

Eyes. Vision was O.D. and O.S. 20/30, corrected to O.U. 20/20. There were bilateral and equal exophthalmos; remote

Pcb.; exotropia for distance and near; no nystagmus. The media and fundi were essentially negative. Visual fields for form showed a slight contraction.

X-ray studies. There was a congenital anomaly of the skull with an increase in the vertical diameter. None of the suture lines were visible. The middle cranial fossa was short and shallow. The sella turcica appeared normal (figs. 17, 18).

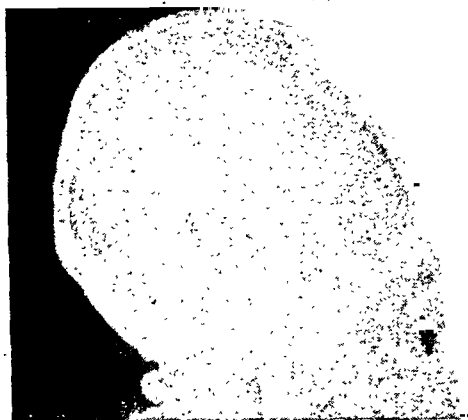


Fig. 17 (Peter). High anterior fossa, low posterior fossa, with elongation of same (case 4).

There was a spina bifida occulta of the upper sacral segment.

Laboratory tests. The Kahn reaction was positive. It was impossible to recheck it or to get any definite history of venereal disease.

CONCLUSIONS

Four cases of mild oxycephaly have been presented, showing, besides the skull deformity, other skeletal defects. The cases are presented primarily to show that this condition exists in mild form and will frequently present few, if any, symptoms.



Fig. 18 (Peter). Typical tower skull, increased digital markings, absent suture lines (case 4).

In the Service the complaint common to all four cases has been that of inability to wear the ordinary type of helmet.

One of the cases presented the unusual syndrome of brevicollis or Klippel-Feil syndrome. Other associated defects were patent parietal foramina, arachnodactylism, and unclassified deformities of fingers, toes, and spine.

A thorough fundus study on all four cases with widely dilated pupils failed to reveal any case of secondary optic atrophy (not traumatic), or the presence of any medullated nerve fibers, as reported by Abeles.

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PENICILLIN IN GONOCOCCIC CONJUNCTIVITIS: ITS USE IN 30 CASES, COMPARED WITH THE SULFONAMIDES IN 173 CASES*

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In 1941, I presented before the American Ophthalmological Society a paper¹ comparing the results of sulfanilamide, sulfapyridine, and sulfathiazole therapy in 120 cases of gonococcic conjunctivitis. Since that time an additional 83 cases have been treated, 23 with sulfathiazole, 30 with sulfadiazine, and 30 with penicillin. The marked superiority of the sulfonamides over presulfanilamide therapy

of penicillin in the treatment of gonococcic infections is also well known. In this series of cases penicillin was used intramuscularly and in many cases it was also used locally. The local use was based on the work of Struble and Bellows,³ who found that the topical application of penicillin resulted in a much greater concentration than could be secured by intravenous or intramuscular administra-

TABLE 1
SULFADIAZINE TREATMENT

Case	Age	Eye	Severity	Local Therapy	Clinical Cure	Hosp. Days	Corneal Involvement	Visual Results	Remarks
1	4 yrs.	O.D.	Severe	Na. Sulfa	4 days	8	None	Unimpaired	—
2	14 days	O.U.	Typical	Na. Sulfa	4 days	8	None	Unimpaired	—
3	9 days	O.D.	Mild	Na. Sulfa	3 days	5	None	Unimpaired	—
4	58 yrs.	O.S.	Typical	Na. Sulfa	6 days	9	None	Unimpaired	—
5	17 yrs.	O.S.	Typical	Na. Sulfa	2 days	4	None	Unimpaired	—
6	33 yrs.	O.S.	Typical	Na. Sulfa	2 days	3	None	Unimpaired	—
7	35 yrs.	O.U.	Typical	Na. Sulfa	5 days	7	None	Unimpaired	Acute urethritis
8	21 days	O.U.	Mild	Na. Sulfa	2 days	3	None	Unimpaired	—
9	20 days	O.U.	Mild	Na. Sulfa	2 days	4	None	Unimpaired	—
10	10 days	O.D.	Mild	Na. Sulfa	3 days	4	None	Unimpaired	Cong. syphilis
11	3 yrs.	O.D.	Typical	Na. Sulfa	3 days	4	None	Unimpaired	—
12	2 mos.	O.U.	Typical	Na. Sulfa	5 days	7	None	Unimpaired	—
13	1 mo.	O.U.	Typical	Na. Sulfa	3 days	5	None	Unimpaired	—
14	6 days	O.S.	Severe	Na. Sulfa	10 days	12	None	Unimpaired	Recurrence
15	22 yrs.	O.S.	Typical	Na. Sulfa	5 days	8	None	Unimpaired	—
16	12 days	O.U.	Typical	Na. Sulfa	6 days	8	None	Unimpaired	—
17	6 days	O.U.	Mild	Na. Sulfa	3 days	4	None	Unimpaired	—
18	9 days	O.U.	Mild	Na. Sulfa	3 days	5	None	Unimpaired	—
19	17 yrs.	O.U.	Mild	Na. Sulfa	3 days	4	None	Unimpaired	—
20	5 yrs.	O.D.	Severe	Na. Sulfa	3 days	4	None	Unimpaired	—
21	15 yrs.	O.D.	Mild	Na. Sulfa	5 days	8	None	Unimpaired	Acute urethritis
22	5 days	O.U.	Mild	Na. Sulfa	5 days	8	None	Unimpaired	—
23	8 days	O.U.	Mild	Na. Sulfa	4 days	6	None	Unimpaired	—
24	25 yrs.	O.D.	Typical	Na. Sulfa	3 days	5	None	Unimpaired	—
25	2 mos.	O.U.	Typical	Na. Sulfa	2 days	4	None	Unimpaired	—
26	25 yrs.	O.U.	Severe	Na. Sulfa	6 days	7	None	Unimpaired	Acute urethritis
27	7 days	O.U.	Typical	Na. Sulfa	3 days	4	None	Unimpaired	—
28	14 days	O.U.	Typical	Na. Sulfa	3 days	5	None	Unimpaired	—
29	7 days	O.U.	Mild	Na. Sulfa	3 days	6	None	Unimpaired	—
30	14 days	O.U.	Mild	Na. Sulfa	2 days	3	None	Unimpaired	—
Average					3.7 days	5.7 days			

has been clearly demonstrated and is known to all physicians.² The great value

* From the Department of Ophthalmology of the University of Tennessee College of Medicine. Read at the eighty-first annual meeting of the American Ophthalmological Society at Hot Springs, Virginia, in November, 1945.

tion. As large series of gonococcic infections of the eyes have become rare, it was felt that a paper summarizing my experience with penicillin and the sulfonamides, and comparing their efficiency might prove of interest and value.

This paper is a brief résumé of the re-

sults obtained in the Isolation Hospital in Memphis with sulfonamide therapy and recently with penicillin. Our first patient with gonococcic ophthalmia treated with one of the sulfonamides was seen in June, 1937. Thereafter all patients were treated with these drugs until July, 1944, when penicillin therapy was started. In the past eight years, to this date, November, 1945, a total of 203 cases have been

Until April, 1940, sulfanilamide was used in all cases; from April, 1940, to February, 1941, sulfapyridine was used; and from February, 1941, to June, 1942, sulfathiazole. Sulfadiazine was used from June, 1942, to July, 1944. Since July, 1944, penicillin has been used routinely except in two or three cases in which it was not available. In a few severe cases a sulfonamide was used in addition to

TABLE 2
PENICILLIN TREATMENT

Case	Age	Eye	Severity	Total Units	Local Therapy	Clinical Cure	Hosp. Days	Corneal Involvement	Visual Results	Remarks
1	14 yrs.	O.U.	Severe	400,000	Na. Sulfa.	8 days	9	Ulcer on admission	Scar 20/70	Perforation Sulfadiazine
2	58 yrs.	O.U.	Severe	640,000	Na. Sulfa.	5 days	7	Ulcer on admission	Scar H. M.	Gc. Urethritis
3	4 wks.	O.U.	Typical	160,000	Na. Sulfa.	5 days	7	None	Unimpaired	Sulfadiazine
4	7 yrs.	O.D.	Severe	320,000	B.-A. Wash (Atropine)	4 days	5	Keratitis	Unimpaired	Bronchopneu. Sulfathiazole
5	29 yrs.	O.S.	Typical	480,000	None	3 days	4	None	Unimpaired	—
6	11 days	O.U.	Mild	60,000	None	2 days	4	None	Unimpaired	—
7	4 yrs.	O.U.	Typical	300,000	B.-A. Wash	4 days	6	None	Unimpaired	—
8	17 yrs.	O.D.	Severe	360,000	Na. Sulfa.	3 days	5	None	Unimpaired	Sulfadiazine
9	52 yrs.	O.D.	Severe	500,000	B.-A. Wash Atropine	4 days	5	Keratitis	Unimpaired	Gc. Vaginitis
10	10 wks.	O.S.	Typical	130,000	Penicillin	4 days	5	None	Unimpaired	—
11	7 yrs.	O.D.	Typical	230,000	B.-A. Wash	3 days	4	None	Unimpaired	—
12	34 yrs.	O.U.	Severe	480,000	B.-A. Wash	3 days	4	None	Unimpaired	Gc. Urethritis
13	10 days	O.U.	Typical	60,000	B.-A. Wash	2 days	4	None	Unimpaired	—
14	14 days	O.U.	Mild	120,000	None	3 days	5	None	Unimpaired	—
15	8 wks.	O.U.	Mild	150,000	B.-A. Wash	3 days	6	None	Unimpaired	—
16	14 days	O.D.	Mild	80,000	B.-A. Wash	2 days	4	None	Unimpaired	—
17	4 yrs.	O.U.	Typical	180,000	B.-A. Wash	2 days	4	None	Unimpaired	—
18	8 mos.	O.U.	Mild	180,000	B.-A. Wash	3 days	5	None	Unimpaired	Otitis media
19	16 days	O.U.	Severe	300,000	Penicillin	4 days	6	None	Unimpaired	—
20	14 days	O.S.	Typical	40,000	Penicillin	2 days	3	None	Unimpaired	—
21	21 days	O.U.	Mild	80,000	Penicillin	2 days	3	None	Unimpaired	—
22	6 days	O.U.	Severe	250,000	Penicillin	5 days	8	None	Unimpaired	Sulfadiazine
23	21 days	O.U.	Mild	140,000	Penicillin	2 days	4	None	Unimpaired	—
24	8 days	O.U.	Typical	80,000	Penicillin	1 day	2	None	Unimpaired	—
25	2 yrs.	O.D.	Typical	280,000	Penicillin	3 days	4	None	Unimpaired	—
26	10 days	O.U.	Typical	60,000	Penicillin	1 day	2	None	Unimpaired	—
27	3 yrs.	O.U.	Typical	180,000	Penicillin	2 days	3	None	Unimpaired	Nephritis
28	8 days	O.S.	Mild	100,000	Penicillin	2 days	3	None	Unimpaired	—
29	20 days	O.S.	Mild	90,000	Penicillin	2 days	3	None	Unimpaired	—
30	21 days	O.U.	Severe	240,000	Penicillin	3 days	5	None	Unimpaired	Sulfadiazine
Average						3 days	4.6 days			

treated. Ninety cases were treated with sulfanilamide, 22 with sulfapyridine, 31 with sulfathiazole, 30 with sulfadiazine, and 30 with penicillin. In six cases both penicillin and a sulfonamide were used. Only cases definitely gonococcic bacteriologically and clinically are included in this report. Numerous cases of conjunctivitis of supposedly gonococcic origin proved to be due to other bacteria, or to be inclusion-body blennorrhea and were therefore excluded from this series.

penicillin. In a large percentage of the cases treated in the past four years specific local treatment was also given. In the majority of cases this consisted in a solution of sodium sulfathiazole, varying from a 1- to 5-percent solution, dropped into the eyes every two or three hours. A 2.5- or 3-percent solution was found to be apparently as effective and not so irritating as the 5-percent solution. Recently penicillin in normal saline, 500 to 2,500 units per cubic centimeter has

been employed by dropping it into the conjunctival sac every two or three hours. We have not tried penicillin ointment, as recommended by Bellows,⁴ in gonococcic infections.

TREATMENT

The present routine at the Isolation Hospital is as follows: When the patient is admitted, smears are taken for examination, and if the patient has the clinical appearance of having a gonococcic infection, treatment with penicillin is started at once. For adults, 20,000 units in 2 c.c. of saline are given intramuscularly and repeated every three hours. For children, 10,000-unit doses are adequate and in infants, 5,000 units or less are sufficient in most cases. The average adult received a total of 400,000 to 500,000 units, while newborn infants usually required about 100,000 units to effect a cure.

None of our patients showed any toxic or allergic reactions to penicillin. In very severe cases, particularly those with corneal involvement, a sulfonamide in addition to penicillin is used. Sulfadiazine, being as effective as sulfathiazole, and slightly better tolerated, is employed. Sulfapyridine, although the most effective sulfonamide, is too toxic and therefore no longer used. The average adult received an initial dose of 30 to 60 grains (2 to 4 gm.) and 15 gr. (1 gm.) every four hours. In the newborn the initial dose of sulfadiazine is 0.5 gr. (.033 gm.) per pound of body weight, after which 1 gr. (.066 gm. per pound of body weight) every 24 hours, is divided and given at four-hour intervals. It is believed at present that the combined use of penicillin and sulfadiazine is very effective, but not necessary as a general routine. There seems to be no contraindication to administering the drugs simultaneously.

Besides the systemic use of penicillin and occasionally sulfadiazine in addition,

the following local treatment is used and recommended:

Mechanical cleansing of the conjunctival sac every two hours by irrigating with cool boric-acid solution, as long as gross pus is visible.

Instillation of penicillin drops, 1,000 to 2,500 units per cubic centimeter of normal saline (after irrigations) every two hours.

Iced compresses in cases in which there is considerable edema of the eyelids and conjunctiva.

Discontinuance of this treatment as soon as the eye is clean clinically and the smears are negative. This occurs usually in from 24 to 72 hours. Following this, zinc sulfate, 2 gr. (.13 gm.) per ounce (30 c.c.) is instilled three or four times a day and continued for about one week after the patient leaves the hospital.

Atropine is used only if there is corneal involvement. For more than five years it has been unnecessary to apply silver-nitrate solution to the conjunctiva, perform an external canthotomy, or give an injection of foreign protein.

RESULTS

It has been previously pointed out¹ that the success of any method of treatment of gonococcic ophthalmitis should be judged by two standards: 1. The preservation of vision, which means the prevention of ulcers of the cornea, or the healing of ulceration which may have already occurred. 2. The rapidity and ease with which a cure is obtained.

The first standard is obviously essential, but the second is of great importance, both from the standpoint of shortening the period of disability and from that of great economic saving. A review of the charts of 50 consecutive patients treated prior to the use of sulfonamides showed the average period of hospitalization to

be 20.3 days. The entire attention of one or more special nurses was not uncommon. By inspection of table 3 the great superiority and the economic saving obtained by modern therapy are obvious. The average period in the hospital was reduced by sulfanilamide to 8.9 days. With sulfathiazole the time was 6.2 days and with sulfadiazine 5.7 days. The

administration in our series of cases. There have been no failures with penicillin and no recurrences in this series.

For the past 4½ years local treatment by instillation of sodium sulfathiazole, 1 to 5 percent, or penicillin 500 to 2,500 Oxford units per cubic centimeter has been used in addition to the systemic treatment in almost all cases.

TABLE 3
COMPARISON OF RESULTS IN 253 CASES OF
GONOCOCCIC CONJUNCTIVITIS

Treatment	Number of Cases	Average Number of Days for Cure	Average Number of Days in Hospital	Unsatisfactory Results*
Presulfonamide therapy	50	17.30	20.30	18
Sulfanilamide	90	5.40	8.90	8
Sulfapyridine	22	2.57	4.85	0
Sulfathiazole	31	4.00	6.2	2
Sulfadiazine	30	3.7	5.7	1
Penicillin	30	3.0	4.6	0

* Visual damage from corneal ulceration, relapses, and very slow clinical and bacteriologic cures are placed under this heading.

period of hospitalization with penicillin averaged only 4.6 days. The average length of time for apparent cure (no pus nor edema and negative smears) with sulfadiazine was 3.7 days. With penicillin it was three days. It is interesting to note that the incidence of gonococcic eye infections has greatly decreased in recent years due to the rapidity and ease with which gonorrhea is cured by the sulfonamides and by penicillin.

SUMMARY AND CONCLUSIONS

During the past eight years and four months, 203 cases of gonococcic conjunctivitis have been treated at the Isolation Hospital in Memphis. One hundred and seventy-three were treated with sulfonamides and 30 with penicillin. Six of the patients who were treated with penicillin were also given sulfadiazine.

No toxic, allergic, nor other untoward reactions have occurred from penicillin

Both the sulfonamides and penicillin are amazingly effective in the treatment of gonococcic infections of the eye. Sulfadiazine, being quite effective and very well tolerated, is at present the sulfonamide that is recommended if penicillin is not available. Penicillin is even more effective. In infants it is easier to administer than a sulfonamide and it may be given without fear of toxic reaction.

The systemic use of both penicillin and sulfadiazine is recommended in very severe cases, especially those with corneal involvement.

To date, we have not felt it justifiable to withhold systemic therapy and rely entirely upon the local use of penicillin in gonococcic ophthalmitis, although we feel that its local use is a helpful agent and should be employed. Penicillin is at present the most effective and the most satisfactory agent for the cure of gonococcic infections of the eye.

Thanks are hereby expressed to Gilbert Levy, M.D., director of the Isolation Hospital Department of the John Gaston

Hospital, and to the hospital staff for their aid in this work.

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OCULOGLANDULAR TULAREMIA*

REPORT OF THREE CASES WITH UNUSUAL CONTACTS

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INTRODUCTION

Since the occurrence of oculoglandular tularemia is becoming more common, a report of three cases which came to the author's attention within one year should prove interesting and instructive.

The oculoglandular symptom complex is not rare. An experienced ophthalmologist should encounter several cases in practice. With the knowledge that tularemia may occur anywhere in the United States, and in many foreign countries, physicians everywhere are becoming mindful of tularemia. The oculoglandular form should, therefore, be more readily recognized, and the number of cases correctly diagnosed should increase.

Within the oculoglandular-symptom-complex group may be listed the following infections: Parinaud's conjunctivitis, leptothrix conjunctivitis (sporotrichosis or leptotrichosis), tuberculous and syphilitic conjunctivitis, the so-called epidemic conjunctivitis (keratoconjunctivitis), conjunctivitis due to Pascheff's or-

ganism (*Micrococcus polymorphicus necroticans*), conjunctivitis due to *B. pseudotuberculosis rodentum*, and tularemic conjunctivitis (*Bacterium tularense*, known also as *Pasteurella tularen. is*). The last named is the most severe type, causing not only grave primary ocular symptoms, but also severe systemic (toxemic) reactions. The other types show, as a rule, manifestations limited to the head and neck, with little, if any, constitutional involvement. Oculoglandular tularemia causes a general systemic response, with malaise, chills, fever, marked prostration, and various complications; in very severe instances, it may lead to death. In all cases, the ipsilateral regional lymph nodes of the head and neck become enlarged, and occasionally also those of the axillary region, leading in severe cases to suppurative adenitis.

Local symptoms. The primary nidus of infection is in the conjunctiva, most commonly in the lower cul-de-sac. The cause of the disease is *B. tularense*. The infection is usually the result of the patient's having inadvertently rubbed or wiped the eye with contaminated fingers. The primary focus may remain limited,

* From the Missouri Trachoma Hospital Division of the Missouri State Board of Health. Read before the Saint Louis Ophthalmic Society, October 26, 1945.

or spread to other parts of the conjunctiva; it may or may not involve the bulbar conjunctiva.

The lesion begins as a reddened, yellowish papule which soon develops into a granulomatous ulcer, lying in a bed of chemotic conjunctiva. The ophthalmia is almost always unilateral, although a bilateral involvement has been reported.^{1, 2} There is little or no initial pain or tenderness. Several days after infection the lids become swollen, a condition that persists, accompanied by itching. At this time, the preauricular lymph gland may enlarge and with continued swelling may become painful and tender.

Upon everting the lids, one sees the conjunctiva to be deeply injected and chemotic, especially in the area surrounding the lesion. The latter may be single or multiple, in the latter case the ulcers may be discretely placed or scattered. The yellowish necrotic tissue that fills in the crater of the ulcer eventually sloughs off and leaves an open, rough area, indurated and thickened with granulation tissue, with raised and irregular edges. Whether single or multiple, these yellowish ulcers mark the site of entry of *B. tularensis*, and form a characteristic sign of the disease. Lying in the bed of engorged and reddened conjunctiva, they have been compared by one observer³ to yellow polka dots on a scarlet dress. There is a scant, mucoserous discharge which tends to agglutinate the lashes during sleep. As a rule, the cornea remains clear throughout the course of the affection. However, ulceration, with perforation followed by prolapse of the iris, has been reported.^{1, 2} The iris maintains its normal luster, with the pupillary reactions intact. The infection seems to limit itself entirely to the mucosa without involving the intraocular structures. Very rarely, purulent dacryocystitis may occur. Intense edema may close the lids tightly.

The general toxemia does not become severe until a week to 10 days following the initial infection, and in the interim the patient thinks of his condition as a purely local affection. Following the ocular distress, the preauricular lymph gland becomes enlarged and painful. This is distinctly palpable as a lumpy swelling immediately anterior to the tragus on the same side as the affected eye. The submaxillary glands usually become enlarged and tender; within a few days the cervical nodes also become enlarged and painful, those of the anterior triangle of the neck being the ones affected. As the disease progresses, the adenopathy becomes more generalized, so that even those of the axillary region are involved. All these nodes increase in size, and occasionally a suppurative adenitis may follow.

General symptoms. The systemic reaction usually makes its appearance within a week of the initial infection. It is characterized by malaise, recurrent chills and fever, and marked debility. Headache, backache, nausea, and dizziness are accompanying signs. The patient seeks to remain at rest. The initial fever is not high, hovering about the 100° F. level, but later rises to 102° or 103°, or even higher. During the latter period, the patient begins to experience more frequent chills and sweats, greater weakness and prostration, and mental depression. Nausea and vomiting not infrequently occur. It is at this stage that the ocular symptoms and adenopathy are most marked.

These severe toxic manifestations may last 24 hours or longer, and then subside suddenly, leaving the patient free of acute distress for several days. The respite may be of short duration, then symptoms return with the same or increased vigor. The active stage of the disease during which remissions and recurrences follow

one another may last from 6 to 12 weeks, or even longer. As the terminal stage of the infection is approached, the recurrences become less and less severe, and more infrequent.

Convalescence is long drawn out; its prolongation being one of the characteristic features of this disease. Complete recovery usually occurs from two to six months following initial infection. Upon attempting an early return to normal duties, the patient soon finds that he is unable to do the amount of work previously accomplished; weakness and readily induced fatigue occur upon the slightest exertion. In fact, this will continue even for many weeks after the force of the infection has apparently been spent, and may last for a year.

The general symptoms described are equally characteristic of the other forms of tularemia; namely, ulceroglandular, glandular, and typhoidal. However, in the oculoglandular form the general symptoms are secondary to the primary ophthalmia and regional lymphadenopathy which dominate the local picture.

The *complications* of oculoglandular tularemia are: (1) suppurative adenitis of the involved lymph nodes, with abscess formation and ulceration through to the skin, necessitating incision and drainage, or surgical removal; (2) occasionally, ulceration of the cornea, with perforation, and prolapse of the iris; (3) acute purulent dacryocystitis; (4) bronchial or lobar pneumonia; (5) hepatitis with enlargement and jaundice; (6) pleurisy with effusion; (7) pericarditis and mediastinal pleurisy; and (8) generalized peritonitis.

While the conjunctival ulcer that marks the original site of entry of infection presents an alarming appearance during the height of the disease, this area heals well, and after recovery only a few faint

striae on the smooth membranous surface, suggestive of a cicatrix, may remain.

The disease is fatal in some cases, in the oculoglandular form as well as in other types. Death occurs in 5 or 6 percent of *all* cases of tularemia—including types other than oculoglandular—reported thus far (to 1944). Francis² has reported a mortality rate of 9 percent in the group of 78 cases of oculoglandular tularemia under his observation, in comparison with a mortality of 6.9 percent in 15,525 cases of tularemia of all types in the United States. It is highly probable that these mortality figures would actually be much lower if *all* the undiagnosed or undiscovered cases (which later recovered) of true tularemia that occur in rural or other areas could be included in statistical reports. Recovery is the rule in man, whereas in the lower animals the reverse tends to hold true. When death ensues, it is due to the septicemia that follows infection, occurring within five days to two weeks after the prodromal period.

The treatment of oculoglandular tularemia is twofold: (1) local, and (2) general. Locally, the instillation of a mild germicidal preparation such as 20 percent neosilvol, or a 1:2,500 metaphen solution, every hour preceded by cold saline or boric compresses may be of help. For general treatment, sedatives, salicylates, rest in bed, mild aperients, and fluids will be conducive to the patient's comfort during the active stage. Foshay⁴ has recently introduced an anti-serum. Although the actual value of serum therapy is still problematical, its use is rational and should be tried, especially in very severe cases, in the hope of preventing the graver complications. Foshay's serum is given in two doses of 7.5 c.c. each intravenously on successive days as soon as a positive diagnosis has been

established. The author recommends the use of nonspecific triple-typhoid vaccine (bacterial vaccine made from *B. typhosus*, and *B. paratyphosus* "A" and "B," Lederle) given intravenously as early in the disease as possible. For adults, an initial dose of 25 million bacteria should be given. The response to this treatment is indicated by the height of the fever and number of chills. After the lapse of a few days the vaccine is repeated, but with twice the amount (50 million bacteria). A third injection of 100 million, and a fourth of 150 million, at appropriate intervals, may be administered. In the case of children, the dose should be adjusted to the age of the patient. A fever ranging from 102° to 105° F. for several hours will usually suffice to produce the effects desired. Artificial-fever therapy has been reported by one observer⁵ to be beneficial. Finally, the use of blood transfusions from a donor who has had the disease and whose serum has agglutinated *B. tularensis* in high titer should be kept in mind, especially in those cases wherein severe complications have arisen and the prognosis is grave. Streptomycin, a recently discovered drug, has been reported to be experimentally effective against tularemia in laboratory animals.

REPORT OF CASES

Case 1. Mrs. A. C., aged 39 years, a white woman, well-developed and well-nourished, the wife of an Army officer, was seen by the author on April 5, 1944, with the complaint that her left eye had been sore for about a week and that the eyelids would swell shut overnight. Examination showed moderate edema of both eyelids, chemosis of the conjunctiva of the lower fornix, and a single, deep, granulomatous ulcer in the conjunctiva of the lower lid. This lesion had been mistaken for a chalazion by a physician. Incision had been followed by a marked

increase in ocular symptoms accompanied by immediate swelling of the left preauricular gland. Examination revealed swelling of the left submaxillary gland, but none in the cervical region at this time.

Inquiry elicited the fact that the ocular distress was first noticed about one week previously, following what the patient termed an "exposure to sneezing by her house cat." While the animal was held on her shoulder, the cat sneezed and projected some of its nasopharyngeal secretion into the patient's left eye. Within three days the eye became itchy, reddened, and inflamed, followed by marked swelling of the lids which caused partial obstruction to vision. Since this was the better-visioned eye of the patient (the right eye being amblyopic), she became very much alarmed.

The cat was an adult female, and had shown signs of being previously ill, characterized by languor, vomiting, and loss of appetite. The animal also had attacks of sneezing, with slight chills, and showed a disinclination to leave its snug retreat within the house. On one occasion, several weeks prior to the incident of sneezing, the pet had been taken to a veterinarian because of the presence of many "open sores" on its belly. These had been removed surgically and were thought by the veterinarian to be ulcerated lymph glands, cause undetermined. The cat recovered from its illness, but later, during the patient's period of convalescence, it suffered another attack similar to, but milder than, the first one.

A more detailed examination showed the cornea and media to be clear, and the fundus negative (the fellow eye remained entirely unaffected). Hyperlacrimation and epiphora were present. Because of the intense edema, the lids were so bulky that handling was quite difficult, and eversion was accomplished only with marked discomfort. Situated in the lower fornix

near the outer canthal angle was a fairly large granulomatous ulcer, raised 1 or 2 mm. above the surface, covered by a yellowish plaque of necrotic tissue, the site of which was much more intensely congested than the surrounding conjunctiva. The presence of a foreign body was ruled out by close inspection, following digital examination of the area from without, and probing of the ulcer from within. Although the preauricular and submaxillary lymph nodes were moderately swollen at this stage, no further regional adenopathy was present. At this time, the constitutional symptoms were not fully developed; the patient complained only of slight dizziness and headache. A tentative diagnosis of Parinaud's conjunctivitis was made, and the patient ordered to remain at home and to limit her activities. Cold boric compresses were applied locally, with salicylates and saline aperients prescribed for internal administration.

A day or so later the patient reported that she was having slight chills and hot flushes, and that she was nauseated. A blood specimen was taken and sent to a local laboratory for examination for possible agglutination reactions to tularemia, but the report was negative. When seen again the inflammatory signs had changed little in appearance, but the preauricular gland had become quite enlarged (about 1.5 cm. in diameter) and was easily palpable and tender. The anterior cervical glands of the middle region of the neck could be palpated. Temperature was 101° F., the pulse 110, and the patient looked toxic. She also complained of sudden weakness upon the slightest exertion. In spite of the negative laboratory report, a presumptive diagnosis of oculoglandular tularemia was made, and the patient hospitalized.*

The first (hospital laboratory) agglutination test made of the patient's blood serum (18 days after the sneezing incident) showed a positive reaction to *B. tularensis* in a dilution of 1:160. A second agglutination test made three days later showed the titer level to be 1:320, indicating the force of the infection to be on the increase. During hospitalization, active treatment was instituted in the form of triple-typhoid bacterial vaccine (nonspecific) given intravenously, with a view to stimulating the formation of allied antibodies to assist in combating the bacteremia. Successive doses of 25, 50, 100, and 150 million bacteria were given. A good response followed with the administration of each dose, manifested by high fever and severe chills, indicating good reactivity on the part of the patient.

As occasion demanded, sedatives and alteratives were given internally to allay the distressing symptoms and malaise associated with the toxemia. The latter progressed with moderate severity during this time, there being short remissions which were followed by recurrences of greater or lesser severity than formerly. Locally, cold boric compresses were applied to the eye, as well as to the preauricular and cervical swellings. The adenopathy meanwhile had become quite extensive, involving finally even the lymph nodes of the left axilla. A colleague was called in consultation when the regional lymph nodes became so intensely swollen and painful that it was feared that surgical incision and drainage would become necessary, but fortunately this was not required.

Within a week after admission, the general adenopathy showed signs of subsidence and resolution. The ocular inflammation had abated: the edema of the lids resolved almost entirely, the conjunctival chemosis disappeared, and the original site of infection presented a moderate-sized ulcer with ragged edges but

* St. Mary's Hospital, Saint Louis.

of much smaller size and showing a reduction in congestion around its base. The patient was discharged after 10 days in the hospital and returned to her home for convalescence.

One of the characteristics of this case was the prolonged period of convalescence. From the onset of illness early in April, 1944, there were periods of recurrence until late in August, 1944, the later attacks marked by decreasing severity. The patient stated that she felt fairly well during the periods of remission, but was unable to perform her normal household duties without extreme fatigue. Restoratives were prescribed during this period, and, in addition, a course of nonspecific foreign-protein (Proteolac) therapy was given intramuscularly. Repeated blood agglutination tests made during the convalescent period showed a decreasing agglutinin titer; the final titer level recorded (August, 1944) was 1:80. Steady improvement followed without recurrence of symptoms, and the patient resumed most of her normal duties without experiencing undue weakness and fatigue. The site of infection in the conjunctiva finally healed completely, leaving little sign or trace of its presence other than a faint, white line.

Case 2. V. W., aged 13 years, a white girl fairly well developed and well nourished, was seen by the writer on November 11, 1944, one week following the onset of a conjunctivitis of the left eye. She complained of persistent soreness and itchiness of the eye, with moderate swelling of the eyelids, which were gummed together in the mornings.

The little patient had recently had a small kitten which died just a few days prior to the onset of the eye trouble. She stated that the kitten had been ill at the time and had experienced several convulsive attacks. She was much affected

by the kitten's illness and while crying, she had inadvertently wiped her eyes after fondling the sick animal. A few days later, her left eye became sore.

There was edema of both eyelids, accompanied by congestion of the conjunctiva, most marked in the upper fornix. There was also present a slight mucoserous discharge. Lying on the palpebral conjunctiva of the upper lid, near the outer angle, was a moderate-sized, raised, yellowish papule, 5 to 7 mm. in diameter, which seemed to be the center of the congested area. No other lesions were present. The cornea and media were clear; the eyeground was normal. The left preauricular lymph node was slightly swollen and tender, but no other regional adenopathy was present. The affection was unilateral.

There was no fever, the pulse rate was not accelerated, but the patient remained at home and in bed. A tentative diagnosis of pneumococcic conjunctivitis was made, but several smears and cultures failed to confirm this suspicion. A blood specimen taken at this time and sent to the laboratory for examination for agglutination reactions to *B. tularensis* was reported negative. For treatment, the eye was given hourly instillations of a 20-percent solution of neosilvol followed with cold boric-acid compresses 20 minutes out of each hour. Sedatives, salicylates, and aperients were given for symptomatic relief.

As the condition progressed, the left anterior cervical lymph nodes became palpable and tender. The preauricular gland had meanwhile become enlarged to the size of a large pea. Also, at this time (approximately 10 days following the onset of symptoms) the child developed a mild fever (99.5° F.) but without chills. She complained of slight malaise and appeared slightly toxic. The lesion now had apparently developed into a fairly

large, granulomatous ulcer with thickened, irregular edges. The yellow plug which filled its center had sloughed off, leaving a raw, intensely reddened crater. Meanwhile, another papule had made its appearance, on the *bulbar* lining of the conjunctiva about 5 mm. posterior to the limbus, and at a site exactly opposite to the first one. This subsequently developed into another ulcer, smaller in size but similar to the first in appearance and characteristics, having a thickened base and covered by a yellow plaque that eventually sloughed off. It was deemed advisable to make another check on the blood-agglutination reaction to tularemia; meanwhile, a presumptive diagnosis of oculoglandular tularemia was made, and the patient hospitalized* for further observation and treatment.

On the day of hospital entry the laboratory report was given to the writer, and this proved to be positive for agglutination reaction to *B. tularensis* in a titer concentration of 1:160. In addition to local and general symptomatic treatment, active protein therapy was instituted, and a series of triple-typhoid (non-specific) bacterial vaccine injections given intravenously, as in the first case of this report, but with the dosage halved. The patient reacted well to the vaccine, responding with high fever and chills. The glandular enlargement soon subsided. Subsequent agglutination tests revealed a decreasing agglutinin titer level: 3d and 4th tests showed positive reactions of 1:80 titer, performed on the 5th and 8th hospital days, respectively. A final test made several weeks after leaving the hospital showed a still lower agglutination titer of 1:40.

The patient returned to her home after a hospital stay of eight days. During con-

valescence the lid edema subsided entirely and both ulcers healed well, leaving no trace of their presence on the conjunctiva. The adenopathy resolved slowly, but the preauricular node remained palpably enlarged for many weeks after the other lymph swellings had disappeared.

Convalescence was slow, but not so protracted as in the former case. Weakness and easily induced fatigue were experienced for several weeks after the patient had left the hospital, but thereafter, restoration followed rapidly and no periods of recurrence were noted. Unlike the patient in the former case, which was marked during convalescence by very many periods of recurrence and remission, this child improved steadily without a single recurrence of symptoms. Restoratives and tonics were given at home to improve the general health. Within three months after the first onset of symptoms, recovery was complete.

Case 3. On March 9, 1945, Mrs. R. M., a white woman aged 23 years, well developed and well nourished, a housewife, came to the eye clinic complaining of a persistent "sore" in the lower lid of her left eye of 10 days' duration. In the beginning, the eye was sore and "itched." Later, on everting the lower lid she observed a moderate-sized lump or "sore" on the inner lid surface. During the days following, her eyelids would agglutinate overnight. Her condition was seen and diagnosed as "pink eye" by her family physician, but as the eye did not improve, and furthermore as her neck had become painful, she reported to the eye clinic at the Trachoma Hospital, where she was first seen by the writer. The first examination revealed a mild degree of edema of the lower lid, with moderate redness of the bulbar conjunctiva and narrowing of the palpebral fissure. The patient's face

*Firmen Desloge Hospital, Saint Louis.

also showed a somewhat anxious expression. When the lower lid was everted, a moderate-sized granulomatous ulcer was found on the conjunctiva, near the outer canthal angle. The surrounding membrane was slightly chemotic, including the adjacent bulbar extension. The iris was of normal luster, and the pupillary reactions intact. The cornea was clear, the eyeground normal. On the left side of the neck, where the patient complained of soreness, there were found to be several enlarged anterior cervical lymph nodes. With further investigation, the preauricular, submaxillary, submental, and axillary lymph glands were also found to be enlarged. A mild fever (temperature 100.2° F.) was present. The patient stated that she had felt somewhat ill for the past week, but ascribed her indisposition to a "cold." She found that she became easily fatigued and did not feel able to carry out her household duties completely.

A search into her present history revealed the following data: Several days prior to the first appearance of her eye disturbance, she had taken care of a sick puppy, aged five months, which had been acutely ill with chills and fever and convulsions for 24 hours previous to its death. When it became ill, the puppy would not eat nor move about, and seemed to be sleepy all the time. The patient nursed the sick puppy, and had noticed that its belly had become "matted" with many lumpy swellings. None of these had ulcerated, however. During the course of feeding the sick animal, the patient admitted that she had often wiped its mouth and eyes with a cloth, and thoughtlessly had also wiped her own eye. Upon being questioned about contact with rabbits (for the patient's family lived in a rural district) her husband stated that about a week or more previous to the

dog's illness he had found rabbit fur scattered all over the yard. This was not unusual, as every now and then a cat or dog living on the premises would catch a rabbit and kill it, sometimes eating its kill, or merely toying with it. He also stated that in addition to this puppy, there was a large female cat on the grounds. Both of these animals would run about freely and hunt or play in the woods near the house. The cat had not been known to be ill at any time, but a blood agglutination test done on this animal later proved to be positive in very low titer (1:10). This cat had several kittens, but none of them was ill. The mother cat later died; she had been sick for many days before death, with symptoms of chills, lassitude, loss of appetite, and distemper. The patient said that she had felt the presence of many lumpy swellings on the cat's belly during its illness. There were two small children in the family, also exposed both to this cat and to the puppy, but neither of them became ill.

A presumptive diagnosis of oculoglandular tularemia was made on the strength of the history and clinical findings. A blood specimen taken at once was examined at the laboratory and later proved to be positive for agglutination to *B. tularensis* in a titer of 1:80. Meanwhile, the patient was hospitalized* and given local and general supportive and symptomatic treatment. For the eye, metaphen instillations and cold boric compresses were used. Ice bags were applied to the preauricular and cervical swellings. Intravenous therapy with nonspecific triple-typhoid vaccine was given in 25, 50, 100, and 150 million bacterial injections. The response to these was fairly good, although the fever rise and severity of chills were not so marked as in the

* Missouri Trachoma Hospital, Rolla.

former instances. During the time of her hospitalization, the patient complained of persistent headache and backache, nausea, and lassitude. Her temperature would vary from 100.8 to 102° F., with frequent chills and sweats. Each exacerbation would leave her weak. After a two weeks' stay she was released from the hospital and ordered to remain at bed rest while at home.

Her period of convalescence was an unusually long one. There were mild febrile symptoms, with occasional chills, and weakness, until seven months after the beginning of infection. During her out-patient visits, the patient complained of headache, dizziness, and easily induced fatigue. Occasionally she would feel well again, but this would be followed in a few days with a recurrence of symptoms which sometimes approached their original severity. A roentgenologic examination of her chest revealed nothing significant to account for the protracted weakness and fatigue, and a constant check was made of her general physical condition.

Because of the protracted illness, the patient was given two 7.5-c.c. doses of Foshay's antiserum intravenously, each on successive days. She reacted with violent chills immediately after receiving the first dose, but otherwise showed no untoward effects. Following the administration of this serum, the patient improved rapidly. Although she still complained of mild febrile reactions in the week following, there were no further signs of chills, sweats, or fatigue. When seen late in the seventh month of her illness, she was found to be well and appeared to be entirely recovered from this infection.

The agglutination reactions showed positive during all this time, in a titer of 1:80 or higher. After the fifth week of her illness, the titer was positive in 1:160,

and remained at this level for many months. The last agglutination test, made seven months after the patient was originally seen, showed a positive titer of 1:160 (October 6, 1945).

During hospitalization and thereafter, the ocular symptoms grew no worse, except that the primary lesion in the conjunctiva had reached and passed its stage of turgescence. The nodular ulcer increased in size and became filled with a yellowish necrotic plaque. This eventually sloughed off, leaving a raw, rough, granulomatous ulcer which healed slowly, but had ceased to be troublesome. Meanwhile, the general adenopathy had not at any time become severe. Although the unilateral preauricular, submaxillary, cervical, and axillary lymph glands had become moderately swollen and painful, there was at no time any question of incision and drainage, nor any sign of abscess formation.

DISCUSSION

The role of the domestic cat as a carrier in the transmission of tularemia was not generally recognized until about 1930. That cats were susceptible to tularemia was noted as early as 1911 by McCoy and Chapin.⁶ Francis⁷ in 1924 infected two cats, one by feeding infected lymph nodes from tularemic guinea pigs, and the other by subcutaneous inoculation with a virulent culture of *B. tularensis*. Both cats died of tularemia. Later, in 1928, Green and Wade⁸ investigated the susceptibility of the cat to tularemia by feeding infective material, and obtained positive results. Simpson¹ in 1929 reviewed the experimental work of Wherry, Green, Wade and Hanson, and that of Francis pertaining to the susceptibility of the domestic cat to infection with *B. tularensis*. Collins⁹ in 1933 reported a case of tularemia in a man, 14 days after he was

bitten on the index finger by a six-months'-old kitten. The cat's serum agglutinated in a titer of 1:80; that of the patient showed a high titer of 1:1,280. Rudesill¹⁰ in 1937 reported tularemia in a woman following the bite of a cat or one of its nursing kittens. The mother cat had fed on a dead tularemic rabbit. A few days later the mother cat and kittens became ill. The mother cat recovered, but the two kittens died. The Public Health Bulletin¹¹ of 1940 reported a total of 13 persons with tularemia after contact with cats, in 2 cases due to a scratch, and in 11 cases due to having been bitten. Shaffer¹² in 1943 reported the following interesting cases of tularemic infection: (a) a patient fondled his family cat, which had been known to have limped for several weeks, and which had a healing ulceration on the skin of the left hind leg. The cat's serum agglutinated *B. tularensis* in a dilution of 1:360. The patient developed tularemia, during which his adenopathy became so severe that the lymph nodes became abscessed and ruptured. (b) Another patient, a boy, was bitten on the left cheek by a domestic cat. The child became ill with nausea, vomiting, and fever several days later. The left cervical lymph nodes became swollen and tender. The blood test showed positive agglutination reaction for tularemia. The cat, a huge animal, was examined but did not seem to be ill and showed no skin lesions, but its blood test showed an agglutination reaction to *B. tularensis* in a dilution of 1:50 (Mulford antigen). (c) A 15-year-old girl was scratched and bitten by the family cat which had been irritable and mean and had scratched and bitten other members of the family. The patient had a slight abrasion on the left index finger where the cat had bitten her several weeks previously. She became subacutely

ill and developed left axillary lymphadenopathy. Her blood serum was positive to *B. tularensis* in a dilution of 1:50. Of the other children who had contact with this cat, one showed a weak positive agglutination reaction, and the other—although her blood test showed negative—developed epitrochlear lymphadenopathy. In this case, although the cat's blood did not agglutinate for *B. tularensis*, it was thought that the patient and her brother and sister were infected from the contaminated animal which itself remained free of infection. The family resided in the suburbs, where the cat was wont to run free and hunt in the fields. Aagard¹³ in 1944 reported the following case: A tularensis-infected rabbit sneezed in the face of a laboratory worker. Although no ocular or glandular symptoms were observed, the patient became very toxic, his temperature rose to 104.6° F., and his pulse to 120. A roentgenogram of the chest showed massive pleural effusion. The serum agglutination tests for *B. tularensis* showed a high positive titer of 1:320. A culture of the patient's pleural fluid revealed *B. tularensis*, and an intraperitoneal injection of this fluid caused death in a guinea pig, with positive autopsy findings of white necrotic foci in liver and spleen.

In the past decade, much light has been shed on the manner of transmission of this disease. Among the various agents now known to be responsible in the transference of the infection to man are: the wild rabbit, beaver, skunk, raccoon, squirrel, woodchuck, muskrat, meadow mouse, rat, fox, coyote, dog, cat, sheep, hog, quail, pheasant, grouse, owl, fish, woodtick, horsefly, deerfly, and other insects. As to methods of transferring infection, Francis² cites contact from wild rabbits through a contaminated hand as first in order of frequency. Other means men-

tioned by him of transferring infection to the eye are by mashing infected tick tissue between the fingers and conveying it to the eye; a fly crushed between the fingers was the cause in another case; contaminated animal blood which spurted into the eye was the cause in two cases; a dog scratch, and contact (while dressing) with a tree squirrel were causes in still other cases.

The greater vulnerability of the conjunctiva to tularemic infection as compared with the unbroken skin is well illustrated not only by the incidences cited by Francis, but also by the last two cases listed in this report. On this point, Francis² mentions that, of 78 cases of ocular infections in the United States, only 6 were accompanied by hand infection concurrently, although the eye and hand in the other 72 cases were subjected to the same source of infection; that is, rabbit tissue, squirrel tissue, groundhog tissue, crushed tick, or crushed fly.

House pets, such as the domestic cat or dog, when kept in rural communities (as in all three cases of this report), may hunt in the fields and thereby become contaminated or infected with *B. tularensis*. The domestic cat's susceptibility to *B. tularensis* has been established, and Francis⁷ has listed the cat among the mildly susceptible animals. When once infected, the cat or dog will show a positive blood agglutination reaction for many years after having been ill; this test, when positive, is conclusive proof of a suspected animal being tularemic.

The strong possibility that sneezing by a domestic cat in the face of the patient was the method of transmission in one case, and that rubbing the eye with contaminated fingers after fondling an infected animal was the method in the other two, must be considered especially since other means of acquiring the infection could not be established. It must be as-

sumed that the mouth and claws of the cat or dog become contaminated by hunting, killing, or eating infected rabbits. In all three instances of this report, the animal became ill, although the adult cat survived in the first case, whereas the kitten and puppy died in the other two cases.

It is regrettable that in all these cases it was not possible to have the animal available for blood-agglutination tests. In the first case, although the cat survived, the patient moved out of state with her pet, and although contacted subsequently by mail in order to secure a specimen for examination, the writer's request was not granted. In the second and third cases, the kitten and puppy had died and had been disposed of before tularemia was suspected; since both the kitten and puppy came of heritage unknown, it was not possible to establish whether or not the parent animals or any of the other litter-mates were infected. The illness of both cats, and of the puppy, although not proved to be tularemia, is in itself a weighty factor to be considered in favor of the probability that the animals were responsible for transferring the infection. It seems reasonable to assume that, in the first instance, the cat's illness was due to tularemia, and that the belly "sores" were a suppurative adenitis; and that its mouth was contaminated with infective material which could have been transferred to the patient's eye during the act of sneezing. With regard to the second instance, the kitten was known to have been ill for several days preceding its death, and during the night on which she kept her vigil with the sick animal, the patient could have transferred infection to her eye by fondling and handling contaminated parts. In the third case, infection could have been transferred to the patient's eye by handling the animal and feeding it while sick.

CONCLUSION

Oculoglandular tularemia, one of the four types of the disease tularemia, although beginning as a local infection of the conjunctiva, can and usually does progress to a state of severe bacteremia evoking a generalized somatic response, characterized by malaise, chills, and fever, and resulting in serious complications. Whether the portal of entry be the conjunctiva, or the skin, once the invading organisms have established themselves in the blood stream, the general response and disease characteristics are the same. In the ocular type, however, the situation is grave because the disease concerns primarily the organ of vision. It behooves ophthalmologists, therefore, to be alert whenever an oculoglandular disturbance presents itself.

The disease known as Parinaud's conjunctivitis is very similar to mild cases of oculoglandular tularemia, and to other oculoglandular symptom complexes. However, Parinaud did not describe bacteriologic findings, and discussed no etiologic factors of his disease. At first thought, it would seem that the cases of oculoglandular conjunctivitis with regional lymphadenopathy which he described were, in fact, cases of oculoglandular tularemia. Gifford,¹⁴ however, believes that Parinaud's conjunctivitis is not identical with oculoglandular tularemia. There is a tendency on the part of ophthalmologists to make diagnoses of Parinaud's disease on insufficient grounds. It is a mysterious disease, and one that is still surrounded by much uncertainty. Vail¹⁵ has referred to it as the *bête noire* of ophthalmology. It is the author's conviction that the two conditions, though similar, are not identical; the greater severity of symptoms of oculoglandular tularemia should distinguish it from Parinaud's disease.

Much doubt can be dispelled, however, by simply making a blood-agglutination test. Ordinarily, the serum agglutinins do not appear in sufficient concentration to yield a positive agglutination reaction before a week to 10 days have elapsed. The test is strongly positive in two to three weeks. A titer level of 1:40 or higher may be considered as diagnostic. In 1932, Foshay⁴ introduced the intradermal test; by its use, it is usually possible to make the diagnosis after the fourth day following onset of symptoms. Smears and cultures of the conjunctival sac are negative because it is usually impossible to cultivate the organisms directly on artificial media. However, washings and scrapings from the conjunctival sac when injected into the peritoneal cavity of the guinea pig will cause death of the animal in 4 to 7 days, if positive. Autopsy findings will then reveal the presence of multiple, minute yellow dots (necrotic foci) scattered throughout the liver and spleen.

SUMMARY

Three cases of proved oculoglandular tularemia have been presented, with symptoms and signs characteristic of the disease, each with a prolonged period of convalescence. In all three cases, a domestic animal (house pet) which had been previously ill was found to have been the closest contact, and therefore deemed to have been the agent of transmission. Although it was not possible to determine positively if the illness of each animal was tularemia because of the lack of agglutination test, the illness in each case was similar to that of other animals known to have had tularemia, and it was thought reasonable to assume that these animal contacts *were* tularemic, and therefore the agents of transmission in the three cases presented.

Trachoma Hospital.

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THE ASSOCIATION FOR RESEARCH IN OPHTHALMOLOGY, INC.

Fiftieth Scientific Meeting

As we go to press, this program has been received, and is inserted here because of its special interest.

PROGRAM

Hotel Mark Hopkins San Francisco, California

JULY 2, 1946

1. THE CYTOLOGY OF CONJUNCTIVAL EXUDATES
Phillips Thygeson, M.D., *Menlo Park, California*
2. MACULAR EDEMA
Arthur J. Bedell, M.D., *Albany, New York*
3. EXPERIMENTAL DINITROPHENOL CATARACT: EFFECTS OF OBESITY, AGE, AND ENVIRONMENTAL TEMPERATURE
Jerome W. Bettman, M.D., *San Francisco, California*
4. CHANGES IN THE ANGIOSCTOMAS ASSOCIATED WITH THE ORAL ADMINISTRATION OF EVIPAL
Austin I. Fink, M.D., *Brooklyn, New York*
5. THE RELATION BETWEEN MATERNAL VITAMIN A, BLOOD LEVEL, AND OCULAR ABNORMALITIES IN THE OFFSPRING
V. Everett Kinsey, Ph.D., Blanche Jackson, Ph.D., and Theodore L. Terry, M.D., Pathology Laboratories of the Massachusetts Eye and Ear Infirmary, and the Harvard Medical School, *Boston, Massachusetts*
6. EXPERIMENTAL GONORRHEAL IRITIS: THE ROLE OF THE LENS IN GROWTH OF THE GONOCOCCUS
Maurice J. Drell, M.D., Marjorie Bohnhoff, M.D., and C. Phillip Miller, M.D., the University of Chicago, *Chicago, Illinois*
7. ELECTROENCEPHALOGRAPHY AND OPHTHALMOLOGY
Alston Callahan, M.D., and Frederick C. Redlich, M.D., Department of Ophthalmology, University of Alabama Medical College, *Birmingham, Alabama*
8. FURTHER OBSERVATIONS ON AQUEOUS VEINS
K. W. Ascher, M.D., *Cincinnati, Ohio*

ANGIOMA OF THE RETINA

REPORT OF TWO CASES WITH FUNDUS PHOTOGRAPHS

OGDEN D. PINKERTON, MAJOR (MC), A.U.S.

Angiomatosis of the retina is relatively rare. The condition is characterized by a vascular growth of the retina followed by exudation, retinal detachment, glaucoma, and other sequelae. When localized in the eye the condition is known as Von Hippel's disease. When accompanied by other vascular tumors of the cerebellum, pancreas, suprarenals, or kidneys the condition is known as Lindau's disease.

During the past three and one-half years about 45,000 eye cases were seen in a large army general hospital outpatient clinic. Two cases of angiomatosis retinae were found. Both occurred in healthy young soldiers, were relatively early growths, and were, as far as could be determined, localized in the eye.

Case 1. A white soldier, aged 27 years, was examined on February 6, 1945. His only complaint was visual fatigue and mild frontal headache when reading. The family history was irrelevant.

Examination revealed: A visual acuity, O.D., of 20/15; O.S. 20/15. The lids, conjunctivas, sacs, corneas, pupillary reflexes, and tension were normal. Fundus study of the right eye disclosed a large pinkish mass about 1.5 disc diameters in size in the inferior nasal fundus into which passed one large dark tortuous artery, and from which a huge dilated dark tortuous umbilicated vein passed upward to the disc (fig. 1). No exudate surrounded the mass. There was no evidence of retinal detachment. The nerve head, macula, and remainder of the periphery were normal. Examination of the fundus of the left eye revealed no pathologic lesion.

Neurologic examination, spinal fluid, blood sugar, intravenous pyelograms, and chest X-ray studies were negative.

Case 2. A white soldier, aged 22 years, was examined on May 15, 1945. He complained of blurred vision in the left eye for the past two weeks. He had been struck in the left eye with a softball about eight months previously, but there



Fig. 1 (Pinkerton). Angioma in inferior retina, case 1.

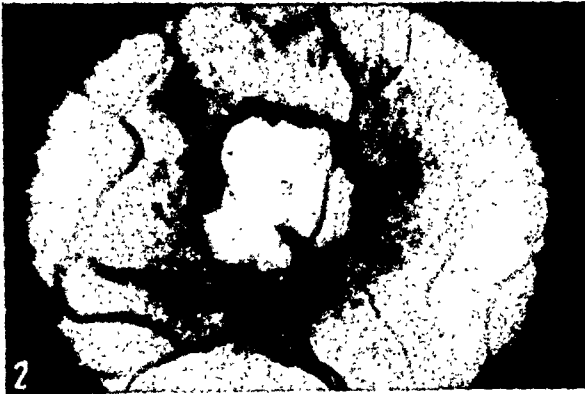
was no blurring at that time. There were no other complaints. The family history was irrelevant.

Examination revealed: Vision, O.D., 20/15; O.S., 20/40-1. The remainder of the external examination gave normal results. The tension was normal. Refraction with homatropine cycloplegia revealed a mild bilateral compound hyperopic astigmatism. Vision in the left eye was improved to 20/30 with dilatation. With pinhole spectacles the vision was 20/50-1. Fundus study of the right eye disclosed, about three disc diameters above the macula, a large pinkish-white area nearly twice the size of the nerve head. Into this mass passed a greatly

dilated artery, and from it came a greatly dilated tortuous vein about twice the size of the artery. Just below the mass were scattered clouds of exudate which passed into the macular area. Some of the exudate was well organized. There were no hemorrhages. The nerve head was blurred, especially on the temporal side. Binocular ophthalmoscopy with the use of red-free light showed that the mass pro-

chest X-ray studies were negative for abnormalities.

The first case presented was early, and had not produced any local symptoms. It should be an ideal case for surgery (perforating diathermy) or radium therapy. The second case was more advanced, and being closer to the macula produced early visual symptoms. Prognosis for vision in the second case is not good in spite of suc-



Figs. 2 and 3 (Pinkerton). Case 2. Fig. 2, angioma above macula of left eye, showing markedly dilated artery and vein. Fig. 3, showing nerve head and exudate extending into macular area.

jected into the vitreous and consisted of a white delicate spongy tissue spotted by capillary tufts. Venous and arterial pulsation was marked. There was no evidence of retinal detachment (figs. 2, 3).

Neurologic examination, spinal fluid, blood sugar, intravenous pyelograms, and

successful surgery, or successful irradiation because of the proximity of the tumor to the macula.

Both patients reported were subsequently returned to the mainland for further study and therapy.

AMBLYOPIA EX ANOPSIA IN THE ARMED FORCES

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This is a report of 77 cases of amblyopia ex anopsia studied in the Armed Forces. An attempt has been made to analyze the significant factors in each of these cases; to correlate them in a fashion that may stimulate a more favorable approach to therapy of similar groups. I do not know what percentage of all the eye cases seen this amblyopic group presents. Downing¹ recently stated that in the examination of 60,000 selectees "amblyopia was responsible for sixty-six percent of all monocular poor vision." That is a high percentage. The series reported here undoubtedly represents a much smaller percentage of the whole.

The purposes of this report are: first, to arouse in the profession a deeper interest in this problem. Too often the cosmetic aspect of strabismus receives first consideration, and the obtaining of good binocular vision comes off a bad second. The parent's view of the situation often influences the ophthalmologist in his philosophy of strabismus. The need to give early attention to cross-eyed children should be stressed in parent-education programs.

Much of this report is of necessity based upon the history given by the patient. Inaccuracies were to be expected, despite time-consuming efforts to avoid them. However, any of the service men or women who had been annoyed by total occlusion of either eye for several weeks would undoubtedly remember something about it.

Amblyopia ex anopsia is not uncommon. In neurology an analogous situation is described:² paralyzes occurring at birth

or in early infancy may be accompanied by marked interference with the tactile sense. No lesions can be found in any part of the afferent pathway from the recipient organs to the cortical areas. The only explanation offered is paralysis of tactile sensation due to disuse. Response to training is similar to that in amblyopia. This, too, is the only explanation of amblyopia ex anopsia. To carry this analogy further, it is interesting to note that a similar hemiplegia occurring after three years of age will produce *no* astereognosis.

To review briefly, the following characteristics of this type of amblyopia are named: 1. Functional impairment of vision in one or both eyes. 2. No demonstrable pathologic lesion. 3. Vision not improved by correcting ametropia. 4. Strabismus may be associated.

It will simplify this discussion to classify the cases according to the following scheme:³ I. Amblyopia associated with squint. II. Amblyopia associated with anisometropia. III. Idiopathic functional amblyopia.

In one of these groups each of the cases observed will find a place. The type associated with squint or with a difference in refractive error between the two eyes needs no further characterizing. However, there are certain cases of amblyopia in which no cause for the visual defect can be found, even after careful and complete examination. Some of these are due, undoubtedly, to well-concealed organic disorders. It is into this third, the so-called idiopathic group, that 10 to 15 percent of all amblyopias fall. The infrequency of amblyopia when not associated with either squint or anisometropia is most pointedly demonstrated by a review

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of 400 consecutive nonsquinting eye cases: (1) showing no demonstrable pathologic change; (2) with 1.75 diopters or less in any meridian of either eye; and (3) with visual axes parallel, three patients had less than 20/25 vision in either eye.³ These latter three cases are the only ones which meet all the requirements of group III. The occurrence of amblyopia is seen, then, to be extremely rare.

When this classification was applied to the cases in military personnel herewith reported the following values were found:

<i>Amblyopia</i>	<i>No. Cases</i>	<i>Percent</i>
Strabismic	43	55.9
Anisometropic	23	29.8
Idiopathic	11	14.3

The strabismic patients in this series of amblyopias comprised 55.9 percent of all the cases; 29.8 percent were anisometropic; 14.3 percent idiopathic.

It is interesting to compare the percentages in this series with those in 34 similar cases of amblyopia in children.

<i>Amblyopia</i>	<i>No. Cases</i>	<i>Percent</i>
Strabismic	18	52.9
Anisometropic	12	35.3
Idiopathic	4	11.7

It is evident that the percentages in this group of children correspond closely to those in the amblyopic cases studied in the Armed Forces.

It may be stated, then, that in any large group of amblyopias, about 50 to 55 percent of the cases are associated with strabismus; 25 to 30 percent, with anisometropia; and the remainder, approximately 15 percent, show no obvious cause for the poor vision.

When a case of amblyopia is fitted into one of these three groups—that is, associated either with squint or with anisometropia, or if it is idiopathic—an immediate prognosis of that particular case is possible. The possibility of predicting the response to treatment in each case of

amblyopia is best illustrated by examining a group of amblyopias in children:³

Group I—Therapy of amblyopia showed about 70 percent success

Group II—Therapy about 50 percent successful

Group III—Prognosis guarded

According to this response, 30 cases of the 43 in this military-personnel group associated with squint should have resulted in normal, or nearly normal, vision under proper treatment. Of 23 cases associated with anisometropia, 11 could have resulted in normal vision. Despite the poor prognosis, treatment of the idiopathic group should not be neglected. Fralick⁴ believes that "no amblyopic eye should be considered due to a congenital defect until all forms of occlusion therapy have been used continuously and totally for a period of several months without demonstrable visual improvement."

With the possibilities of visual improvement that have been demonstrated, it is interesting as well as important to examine the histories of these patients. Again it should be stated that a history as given by these older patients is not an adequate basis for criticizing the type of therapy they had received.

- I. Patients under seven years of age seen by physicians... 41.5 percent
- II. Patients under seven years of age for whom occlusion was suggested 9.0 percent
- III. Average age when patient was first seen for ocular examination nine years

In other words, more than one third of these 77 amblyopic patients gave a history of having had a complete eye examination before they were seven years of age. Only one tenth of them recalled having undergone any type of ocular occlusion. Nine years was found to be the average age at which these patients were first seen for their eyes. Perhaps no

criticism should be offered to the ophthalmologists in these cases. Many circumstances may be peculiar to each case. It is interesting to observe, however, that many of these patients could have had good visual acuity in both eyes had it been possible to institute proper early therapy. The late age at which most of these patients were seen constitutes a problem; one that has been approached by a committee studying problems in public schools pertaining to children's eyes. They reported on: "(1) methods of examination, (2) preventive measures, (3) reading problems, and (4) care of patients unable to pay a private physician."⁵ Hunt and Betts⁶ have also reported a study made on a group of grade-school pupils. They believe an urgent need for additional studies exists. When opportunities are presented, the attention of parent-teachers associations and other such groups should be called to this problem of the cross-eyed child.

The subject of proper treatment of amblyopias is not the object of this communication. Briefly to summarize after Gifford⁷ it may be stated that the treatment of strabismus (and this may apply to the other amblyopias) should be started early—Gifford believes as early as one year of age. He suggests full correction under cycloplegia and occlusion of the squinting eye. He assumes that this eye (in monocular squint) is amblyopic. Lancaster has outlined the essential steps to success in treating amblyopia in stating: "A child with convergent strabismus and amblyopia of the left eye first learned to see with the amblyopic eye by occluding the right eye; he next learned simultaneous perception, then fusion, then stereoscopic depth perception on the synoptophore, and, finally, good binocular vision as a habit; i.e., not merely on the synoptophore but in casual seeing."⁸

One of the patients studied in this

series was an enlisted member of the WAC, 33 years of age. She gave a history of having had convergent squint of the left eye since early infancy. At about three years of age she was first seen by an ophthalmologist. Glasses were prescribed. She returned approximately every year for examination. At five or six years of age the right eye was occluded for a period of one half to three quarters of an hour two or three times daily. This schedule was strictly kept for a period of about three months. There was no history of fusion training or surgery.

The eye findings before recent squint surgery were as follows: Vision: O.D. 20/20, correctable to 20/25; O.S. 20/100, correctable to 20/30. Manifest refraction: O.D. +2.25D. sph. \approx +2.25D. cyl. ax. 90°; O.S. +4.75D. sph. \approx +1.75D. cyl. ax. 105°, prism base down.

The visual axes were parallel with glasses; without glasses, there was 16^A convergence in the left eye. Inconstant first-grade fusion was present.

This case is reported because it is similar to several in the group which have received at least partial therapy. It calls attention to one factor that must not be overlooked; namely, the large number of adults in this age group who had received such good therapy, early, that they have not been referred to the ophthalmologist in the Army.

The following table will show an analysis of the 18 cases of amblyopia in children. The original vision, final vision, and months of occlusion necessary are shown:³

RESPONSE OF AMBLYOPIC EYE TO OCCLUSION			
No. Cases	Original Vision	Final Vision	Months of Occlusion
5	8/200 to 20/100	20/30 to 20/20	4 mos.
5	18/200 to 20/100	20/30 to 20/20	3 mos.
5	20/200	20/30	6 wks.

Today, when the stress of social reforms is heavy upon us, it would not be

amiss to encourage some sort of Modern Children's Crusade of our own. It is believed that strabismus is on the increase. This, if true, means an increase in the number of amblyopic eyes, because, as has been shown, 50 percent of these amblyopic individuals have strabismus. The tendency toward an increasing incidence of amblyopia probably is occurring, also, in that group which is due to refractive error. Major Shure,⁹ in reporting 65 cases of strabismus in adults, believes he noted "a definite relation between refractive error and amblyopia." Ophthalmologists should be all the more stimulated to enter upon a crusade against this latter type of amblyopia because of the recent successes in correcting aniseikonia.

The question sometimes still arises of the practical value of prescribing lenses where a large difference between the retinal images of the two eyes exists. Can such patients attain comfortable binocular vision? Briefly, a case reported by Burian¹⁰ might be mentioned, in which was demonstrated what can be accomplished in some of these patients. Burian prescribed eikonic lenses for a patient with the following corrections: O.D. -6.75D. sph.; O.S. +1.00D. sph. \approx -1.37D. cyl. ax. 155°. Comfortable binocular vision was obtained. The good results obtained in this case of high anisometropia convey some idea of what can be done with the 35 percent of amblyopias which fall into this group. The difference in refractive error found in the cases of this series was generally much smaller than in Burian's case.

To summarize and emphasize the favorable response to proper therapy in the type of amblyopias discussed, Zimmermann's¹¹ report of 68 cases is given:

RESPONSE OF GROUPS TO THERAPY

I. Amblyopia associated with unilateral squint in Zimmermann's cases: In 68 cases, 20/20+ vision was obtained in 62 clinic cases studied -91.2 percent. In 18 cases, 20/30+ vision was obtained in 16 -88.8 percent.

II. Amblyopia associated with anisometropia: In 12 cases, 20/30- vision was obtained in 5.

III. Idiopathic: In four cases, 20/30- vision was obtained in one.

SUMMARY

Seventy-seven cases of amblyopia ex anopsia in the Armed Forces have been reviewed. Fifty-six percent of these were associated with strabismus; 30 percent, with a marked difference in refractive error between the two eyes; in the remaining 14 percent no associated etiologic factor was noted. Almost one half of this group was seen by an ophthalmologist before the patient was seven years of age. Less than one tenth gave any history of undergoing ocular occlusion at any time. The average age at which these patients were seen was nine years. Reports of similar cases treated properly in childhood are given. The attention of ophthalmologists is directed to this ocular syndrome in order to stimulate more interest in its early and adequate therapy.

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DETERGENTS OR WETTING AGENTS

PHYSICAL AND CHEMICAL CHARACTERISTICS

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Recently, in a review of contact-lens solutions,¹ it was stressed that one condition essential to the comfort of the contact-lens wearer is the maintenance of a state of dynamic equilibrium in so far as corneal permeability is concerned. When such a state exists, the efflux of water from the corneal cells is equal to, and balanced by, the influx of water into the corneal cells, so that the cornea does not become desiccated by the loss of water or "water-logged" from imbibition of excess water.

With regard to ophthalmic drugs that are administered topically, however, the desired effect is the absorption or influx of the drugs into the cornea. That corneal permeability, as contrasted with permeability of the globe, should be considered is emphasized by Swan and White,² who mention that Laquer, in 1876, demonstrated that absorption into the eye from the conjunctival sac is primarily through the cornea. Pertinent to corneal absorption, Swan and White,² propose the following postulations:

(1) The penetration of drugs into the normal cornea is a complex process the rate of which is determined by factors

similar to those affecting the penetration of other cells.

(2) The molecular structure and resultant physical properties of a drug rather than molecular size affect the penetration rate into the normal cornea.

(3) The physical properties of the drug vehicle, especially the affinity of the drug for the vehicle, may affect the penetration rate of the drug into the cornea.

A survey of recent ophthalmologic literature shows there is a more extensive recognition of the value of using the proper drug vehicle or solvent in which the drug is to be dissolved or suspended. Riser³ discusses tonicity, hydrogen-ion concentration, buffer solutions, preservatives, and surface tension in the evaluation of eye drops and reports that wetting agents which produce increased penetration of the cornea by ophthalmic drugs are the latest trend toward more efficient drops and ointments.

That wetting agents increase the penetration of the cornea by sulfonamide compounds, particularly sulfathiazole, was demonstrated by Bellows and Gutmann.⁴ Using a wetting agent known as zephiran, O'Brien and Swan⁵ were able

to increase the absorption of carbaminoyl choline chloride. For preoperative use, Scholz⁶ suggests the use of a detergent, as less irritating to the conjunctiva, in the cleaning of the lids, brow, and adjacent skin.

Under certain conditions, wetting agents may increase the efficacy of the more commonly used antiseptics by making them more penetrating and more effective. Taub⁷ emphasizes the fact that detergents of specific molecular structures are effective germicides and disinfectants.

An unusual property of detergents that should have a wide field of application in pharmacologic research is the ability of detergent solutions to dissolve otherwise insoluble materials. McBain and co-workers⁸ believe that it is possible to solubilize almost any material in almost any solvent through the presence of a few tenths of a percent of a suitable solubilizing detergent. Two advantages of local application of chemotherapeutic drugs, as listed by Bellows,⁹ are the achievement of a high concentration and the avoidance of systemic toxic manifestations. Bellows describes his use of a few wetting agents as a simple and effective method of increasing the penetrability of sulfanilamide and its derivatives.

Since most drugs in single doses reach a higher concentration in ocular tissues by oral administrations than by local application, and since many drugs may be only slightly soluble in the solvents generally used, the need for further investigation of wetting agents as components of the drug solvent is obvious.

Because there is no reference in ophthalmologic literature to the characteristics and properties of wetting agents, and since their use in ophthalmic therapy will undoubtedly increase, it is proposed here to review the chemical and physical characteristics of wetting agents.

For our purpose, detergents, or wetting agents, may be defined as substances which decrease the surface tension, thus inducing a greater degree of wetting. Detergents, or wetting agents, have also been called cleaning agents, dispersing agents, solubilizers, penetrants, emulsifiers, and surface-active agents. In structure, the molecules of a wetting agent possess a polar (hydrophilic, or water-attracting) portion and a nonpolar (hydrophobic, organophilic, lipophilic, or hydrocarbon group) portion. In the approximate decreasing order of effectiveness, Snell¹⁰ lists the following groups as the hydrophilic portion of the molecule: $-\text{OSO}_2\text{Na}$, $-\text{COONa}$, $-\text{SO}_2\text{ONa}$, $-\text{OSO}_2\text{OH}$, $-\text{SO OH}$, $-\text{OH}$, $-\text{SH}$, $-\text{O}-$, CO , $-\text{CHO}$, $-\text{NO}_2$, $-\text{NH}_2$, $-\text{NHR}$, $-\text{NR}_2$, $-\text{CN}$, $-\text{CNS}$, $-\text{COOH}$, $-\text{COOR}$, $-\text{OPO}_3\text{H}_2$, $-\text{OPO}_2\text{H}_2$, $-\text{OS}_2\text{O}_2\text{H}$, $-\text{Cl}$, Br , I and unsaturated bonds such as $-\text{HC}=\text{CH}-$, and $-\text{C}\equiv\text{C}-$ which, when present in the molecule, promote solubility in water.

The lipophilic portions of the molecule may range from straight hydrocarbon chains to branched hydrocarbon chains and even to modified aliphatic or aromatic rings.

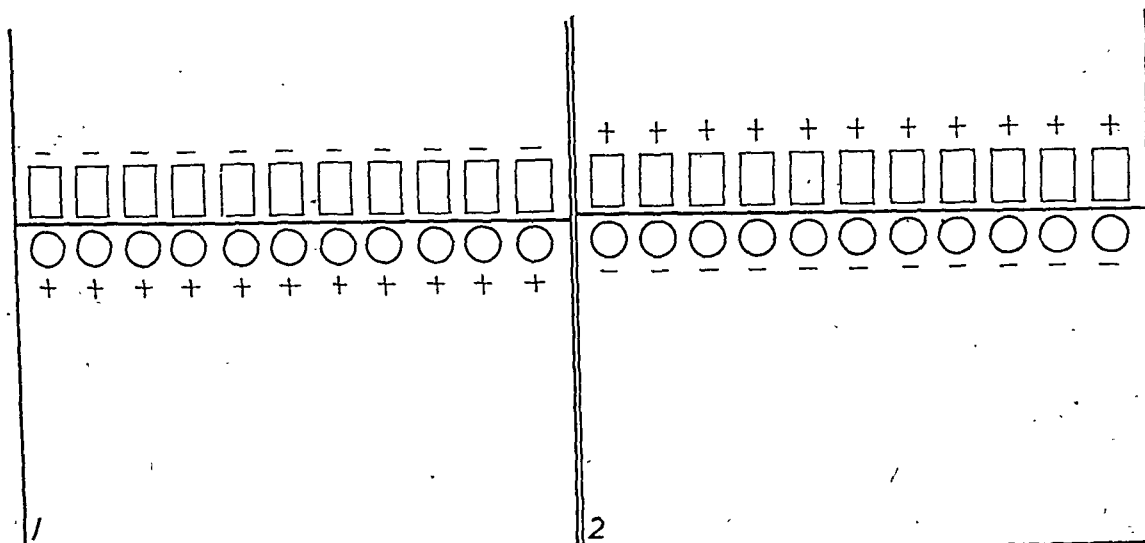
Unless the hydrophilic and lipophilic tendencies of the molecule are well balanced, the efficiency of the wetting agent may be lost, according to Bartell,¹¹ since the portion of the molecule with the stronger character will tend to carry the molecule too completely into that phase for which the solubility tendency is greater. The generalization by Snell¹⁰ that molecular weights of commercial wetting agents concentrate strikingly around 300 ± 50 can be explained by the fact that the individual water-attracting groups are not powerful enough to balance a longer hydrocarbon chain than corresponds to a molecule of this size.

Undoubtedly, the oldest wetting agent

is soap. Today, as many as a thousand patents for wetting agents have been issued. Antwerpen¹² lists about 300 surface-active agents manufactured and commercially available in the United States.

It was Gibbs who first predicted that substances which reduce the surface tension of water will concentrate in the boundaries of their solutions. Later, Hardy proposed the concept that, in lubricating oils, certain molecules so oriented themselves that their "heads" bit into the

thickness, the constancy of the area occupied by the various members of the homologous series of fatty acids; Langmuir concluded, was attributable to the fact that the molecules were standing on end, so oriented that the hydrophilic groups turned toward the water and the lipophilic groups turned away from it. This is shown by Morris,¹³ with the hydrophilic portion of the molecule immersed in water and the lipophilic end projecting into the gaseous phase over the water (fig. 1).



Figs. 1 and 2 (Roth). Fig. 1, Hydrophilic portion of molecule immersed in water and lipophilic end projecting into gaseous phase over water. Fig. 2, Compound whose lipophilic end bears a positive charge.

metal while their "tails" were directed toward the oil. By moving a barrier across the surface of a solution of a surface-tension depressant, Pockels caused a change in surface tension, proving that the molecules of the substance in solution were concentrated in the surface.

Ingeniously measuring the area occupied on the surface of a solvent (water) by different members of the homologous series of fatty acids (that is, $C_nH_{2n+13}COOH$), Langmuir, in his classic studies of monomolecular surface films, showed that the area did not change as the length of the hydrocarbon chain increased. Since the film layer was monomolecular in

A soap such as the sodium salt of palmitic acid, $CH_3-(CH_2)_{14}-COONa$, would orient itself so that the lipophilic portion, $CH_3-(CH_2)_{14}$, projects into the gaseous phase while the hydrophilic portion, $-COONa$, is immersed in the water. The surface of this solution would be oil-like in character. This type of agent, wherein the hydrophilic portion is the positive ion, is called a cationic agent.

Also possible are compounds, the lipophilic end of which bears a positive charge (fig. 2). These compounds are also known as invert or reversed soaps. These wetting agents are best as antiseptics or bacteriostatics. When the hydrophilic portion is

negative, the detergent is known as an anionic group.

Nonionic agents are those whose molecules consist of two nonionizable groups.

Because of (1) the orientation of the wetting-agent molecule, (2) the selective solubility of the hydrophilic portion of the molecule in water, and (3) the lipophilic portion in oils and nonpolar solvents, the interfacial tension between water and the drug to be dissolved, and between the solution of the drug and the cornea, is reduced. Increased corneal permeability to the drug is the consequence of the reduced surface tension.

SUMMARY

Recent applications of wetting agents in ophthalmic-drug therapy seem to warrant investigation for more extensive use.

The physical and chemical characteristics of wetting agents are reviewed.

Two properties of wetting agents that can be used to advantage in ophthalmic-drug solutions and ointments for local administration are: (1) increased solubility of the drug in a solution of the proper detergent permitting a higher concentration of the drug in solution to come in contact with the eye; (2) increased corneal permeability.

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NOTES, CASES, INSTRUMENTS

MENINGOCOCCIC KERATOCONJUNCTIVITIS

REPORT OF A CASE TREATED WITH
PENICILLIN

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Meningococcic conjunctivitis has been observed rarely as a complication of meningitis and even more rarely as a primary infection and then usually during an epidemic of meningitis. Therefore, the following case of a sporadic exogenous meningococcic keratoconjunctivitis, possibly the first to be treated with penicillin, is reported.

A white soldier, aged 18 years, was admitted to the Eye Service of an AAF Regional Hospital because of a keratoconjunctivitis of the right eye. At noon on June 1, 1945, three days prior to admission, the patient had noticed that his right eye was "blood shot." There were no other symptoms at the time, but on the following day there was a slight purulent discharge. By June 3d, although the discharge was not more abundant, there was an increasing redness of the eye and the lids were swollen. When seen in the Eye Clinic on June 4th, all the symptoms had become more pronounced, and, in addition, photophobia had developed.

Examination revealed a muscular young adult male, in excellent physical condition except for the right eye. The patient's head was bowed and eyes were closed in an effort to avoid light. There was a constant flow of tears over the right lower lid and cheek. Both right lids were dull red, swollen, and indurated. There was a slight purulent discharge along the lid margins and a slight pale-

yellow discharge in the lower fornix. The palpebral conjunctiva was bright red on both lids and was thickly studded with follicles, especially over the lower lid. The bulbar conjunctiva was bright red toward the fornices, but in a zone approximately 5 mm. broad surrounding the cornea the color was a deep, purplish red.

Grossly the cornea appeared hazy around the periphery. Examination with the slitlamp and corneal biomicroscope revealed this haziness to be due to superficial stromal infiltration. The infiltration was diffuse in a circular band, approximately 3 mm. broad, with three, round, denser aggregates of the infiltration above between the 10-o'clock and 2-o'clock positions, and four below, between the 4-o'clock and 8-o'clock positions. Each of these aggregates measured approximately 2 mm. in diameter. The corneal surface was intact and did not take fluorescein stain. There were a few fine floaters undergoing thermal circulation in the anterior chamber. The pupil was approximately 3 mm. in diameter but reacted to light.

The right preauricular lymph node was pea-sized and tender.

There was slight injection of the conjunctival vessels of the left eye; otherwise, it was normal.

Laboratory examination. Secretion and scraping smears made at the beginning of the examination were reported by the laboratory to show many gram-negative intracellular and numerous extracellular biscuit-shaped diplococci. Repetition of this examination resulted in the same findings.

A culture was made upon a blood-agar plate and incubated at normal atmospheric conditions, but no growth was obtained from either eye. However, chocolate-agar (starch-base) plates inoculated

TABLE 1
TREATMENT SCHEDULE AND RELATED LABORATORY FINDINGS

Date	Hour	Penicillin Dose units	Smear Findings		
			No. WBC Counted	Phagocytic WBC percent	Extra- cellular* Diplococci
June 4	1630	—	200	7	195
	1800	20,000	—	—	—
	1900	—	200	12	37
	2000	—	200	2	9
	2100	20,000	200	1	2
	2200	—	500	0	2
	2300	—	500	0	0
	2400	20,000	1000+	0	0
	0100	—	1000+	0	0
	0200	—	1000+	0	0
5	0300	20,000	1000+	0	0
	0400	—	1500+	0	0
	0500	—	Entire Slide	0	0
	0600	20,000	Entire Slide	0	0
	0700	—	Entire Slide	0	0
	1100	—	Entire Slide	0	0
	1600	—	Entire Slide	0	0
	0800	—	Entire Slide	0	0
	1630	—	Entire Slide	0	0
	0800	—	Entire Slide	0	0
6	0800	—	Entire Slide	0	0
7	0800	—	Entire Slide	0	0
8	0800	—	Entire Slide	0	0

* Number of extracellular diplococci encountered in relation to number of WBC counted.

at the same time and incubated in 10-percent carbon dioxide yielded a pure growth of oxidase-positive, gram-negative diplococci, from the right eye. Because of the colonial morphology and rapidity of growth, it was suspected that the organisms were meningococci rather than gonococci. A positive agglutination reaction with polyvalent meningococcic antiserum and the fermentation of both dextrose and maltose were definite confirmatory evidence. A subculture sent to the 6th Service Command Laboratory for typing was reported as *N. intracellularis*, Type I.

A combined secretion and scraping smear was made every hour after the institution of treatment for 13 hours, than at less frequent intervals (see table).

Treatment. The treatment consisted of five intramuscular injections of 20,000 units each of penicillin made at three-hour intervals.

Two drops of 0.2-percent aqueous solution of scopolamine hydrochloride were

instilled during the course of the original examination in order to control photophobia, and the patient was allowed to use cold compresses on the eye for comfort.

Clinical course. The purulent discharge increased from the time of examination until two hours after the first injection of penicillin, then rapidly diminished and disappeared within 12 hours after the beginning of treatment. Swelling, redness, and induration of the lids began to diminish within 24 hours, and the lids appeared normal externally within four days. Conjunctival redness and injection disappeared within five days. The circumcorneal injection faded, and the cornea returned to normal within four days. The right preauricular lymph node was not palpable after the third day. Visual acuity of the right eye was 20/15-2 on the sixth day and fourteenth day following treatment. Visual acuity of the left eye was 20/25, but always had been "weaker" than the right eye.

DISCUSSION

The chief interest of the case was the bacteriologic and cytologic response to penicillin. All smears containing bacteria, made after institution of treatment, revealed a change in morphology, both of the intra- and extracellular organisms. Instead of the typical coffee-bean or biscuit-shape, the cocci were swollen and more nearly spherical. In addition, smears made one hour after the injection of 20,000 units of penicillin showed an increase in the percentage of white cells that had phagocytized bacteria as well as an increase in the number of bacteria within the individual phagocytes. However, phagocytosis diminished rapidly in subsequent smears, but this probably was related to the rapid reduction in the number of bacteria. No bacteria were found in smears made after the fifth hour of treatment. At that time the patient had been given a total of 40,000 units of penicillin. However, treatment was continued until a total of 100,000 units had been given.

SUMMARY

A case of sporadic exogenous meningococcic keratoconjunctivitis that developed at an Army Air Base in the absence of other cases of meningococcic infection was cured rapidly by five intramuscular injections of 20,000 units each of penicillin given at three-hour intervals.

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USE OF PENICILLIN IN ACUTE DACRYOCYSTITIS

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The favorable reports on the local use of penicillin in external diseases of the eyes have been encouraging. We have recently seen four cases of acute inflammation of the lacrimal sac with all the clinical signs of early abscess formation.

There was also cellular infiltration of the adjacent tissues of the upper and lower lids and cheek. In one case, the infection was so deep seated that it probably involved the periosteum; the swelling of the lids was so marked that the eyes were completely closed, and the lids had to be forcibly separated, so that the eyeball could be inspected. We did not make an incision because there was a history of poorly controlled diabetes. This infection cleared up completely with the local use of penicillin.

CASE REPORTS

Case 1. Mrs. A. S., aged 52 years, a housewife, consulted me on May 2, 1945, with a history of tearing and secretion from her left eye for the past three years. This had been treated at irregular intervals. She gave a history of uncontrolled diabetes, also occasional head colds that aggravated the tearing. Her physician claimed that her nose and sinuses were entirely normal.

The patient stated that about 10 days before her first visit, there had been a great deal of redness and swelling in the corner of her eye which spread to her eyelids and cheek, and was accompanied by moderate pain, cervical adenitis, and a slight rise in temperature. She was treated by her physician with drops and hot applications, but the condition became steadily worse.

On examination, there were all the clinical signs of early abscess of the lacrimal sac, and a mucopurulent secretion was easily expressed from the lower punctum. A smear showed the preponderance of staphylococci. An examination of the eyeball revealed marked injection of the tarsal and bulbar conjunctiva. The media were clear. The fundus showed no pathologic change except some fullness of the retinal veins.

The infection probably involved the

periosteum, and although incision and drainage were indicated, I was reluctant to operate because the patient had given a history of poorly controlled diabetes.

Local applications of hot magnesium sulfate were advised. When she returned in 48 hours, she said that the pain had subsided slightly, but the redness and swelling remained unchanged. A 2-c.c. solution of penicillin (1,000 units to 1 c.c.) was instilled into the lacrimal sac. There was some regurgitation from the punctum. The same solution was prescribed, 2 drops every 2 hours. This treatment was accompanied by the application of local heat.

When the patient returned two days later, the pain, redness, and swelling had noticeably subsided. The same dilution of penicillin was instilled into the punctum, and the use of penicillin was continued for three more days. At the end of that time, there was such marked improvement that the instillation of penicillin was repeated and the patient advised to continue the use of penicillin three times daily for one week. By the end of that week, the redness, tearing, and swelling had completely cleared up. Penicillin was again instilled, and there was some regurgitation from the punctum. The therapy was then discontinued. On her last visit (June 11th), there was no indication of any previous infection; the area over the lacrimal sac and the adjacent tissue appeared entirely normal, and there was no tearing.

Case 2. Mr. A. J., aged 55 years, a jeweler, consulted me on April 11, 1945, and gave a history of tearing from his right eye during the past two years. This would become aggravated during the winter months. A complete physical examination by his physician, including nose and sinuses, was entirely negative.

For the past three weeks, following a head cold, the secretion had become thickened and was accompanied by pain, redness, and swelling over the area of the

lacrimal sac. The first examination revealed all the clinical signs of an acute purulent dacryocystitis. The area was sensitive to the slightest pressure. A smear taken showed the preponderance of staphylococci. The eyegrounds were entirely negative.

Penicillin solution (1,000 units to 1 c.c.) was instilled into the lacrimal sac. There was some regurgitation. A solution containing 500 units per 1 c.c. was ordered instilled every three hours, in addition to local hot applications of magnesium sulfate.

When the patient returned after three days, the redness and swelling were greatly diminished. The instillation of penicillin was continued. One week later, the redness, pain, and swelling had subsided completely. Penicillin solution was discontinued at the end of 10 days.

A reexamination on April 30th, showed the area over the lacrimal sac to be normal in appearance. There was slight tearing.

Case 3. Mrs. L. B., aged 59 years, a housewife, was first seen on June 4, 1945. She gave a history of tearing from the right eye at irregular intervals during the past year. She had received treatments (probing) which cleared up the tearing temporarily. About 10 days prior to her visit, the area over the lacrimal sac had become red and painful. This was accompanied by a thick, yellowish secretion.

On examination, I found all the clinical signs of an acute dacryocystitis. A smear taken showed a mixed infection—staphylococci and a few streptococci. The same procedure (used in cases 1 and 2) was employed; that is, instillation of penicillin (1,000 units to 1 c.c.) and local heat applications. Two drops of penicillin solution, 500 units to 1 c.c., were ordered instilled every two hours.

Three days later, the redness and swelling were reduced; within a week, this had

completely subsided, and the use of penicillin was discontinued. There had been no recurrence when this patient was last seen on June 19th.

Case 4. Mr. A. L., aged 63 years, a business man, consulted me on August 14, 1945, with a history of pain, redness, and swelling over the left lacrimal-sac area for about two weeks. He gave a history of tearing from that eye during the past year with occasional treatment (probing) without receiving any relief.

An examination showed all the usual signs of an acute dacryocystitis. There had been a spontaneous perforation the day before his visit, and a sinus resulted over the area of the sac.

Penicillin solution (1,000 units to 1 c.c.) was instilled, and penicillin ointment (1,000 units to 1 gram) was ordered applied every three hours to the inner canthus to the area over the sinus.

Three days later, the redness and swelling had subsided greatly. The instillation of penicillin was repeated, and the use of the ointment was continued at less frequent intervals for about two weeks.

This patient was kept under observation for several weeks. The instillation of penicillin was discontinued as soon as the redness and swelling over the sac had subsided, but penicillin ointment was continued until the sinus had completely healed over. The last examination, on September 10th, revealed no evidence of any previous inflammation of the lacrimal sac; some tearing persisted, however.

CONCLUSION

Four cases of lacrimal-sac inflammation with early abscess formation have been reported. In one case, an incision was not deemed feasible, due to poorly controlled diabetes. In the other cases, incisions were not made because the swelling was hard to touch and not localized.

Smears taken showed the preponder-

ance of staphylococci, and, after the inflammation had subsided, the bacteria were less numerous. The same procedure was employed, instillation with no attempt at irrigating the sac. The use of penicillin solution or ointment was prescribed. Ointment was obtained more easily than the solution. The results were excellent.

All patients were healthy in appearance, although each one gave a history indicative of a former infection of the sac or stenosis of the nasolacrimal duct; their general health was excellent.

While I realize these cases are limited in number and that penicillin is not a panacea for all lacrimal-sac infections, I believe these results prove that further study would be justified. When local treatment is indicated, the employment of penicillin has proved of value, at least in ameliorating the symptoms of acute inflammation of the lacrimal sac.

65 Central Park West.

INDIVIDUALLY MADE ACRYLIC MOIST-CHAMBER SPECTACLES AND PINHOLE GLASSES

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Drew Field, Florida

Condensation chambers and pinhole glasses each require an accurate fit to the contour of the face around the eyes, the former in order to obtain an air-tight seal and the latter to prevent light leaks. The presently used types of chambers, shields, and glasses do not satisfy this requirement too well. It is accomplished, however, by a new kind of appliance to be described.

The prevention of evaporation of tears from the corneal surface whenever inadequate closure of the eyelids exists, as in Bell's palsy, exophthalmos, burns, and traumatic defects of the lids, is a well-established therapeutic principle. It is

similarly desirable to avoid minor injury to the cornea when it is analgesic or hypesthetic; as, for example, in neuro-paralytic keratitis, herpes simplex corneae, and Fuchs's epithelial dystrophy. For all these purposes various types of shields and chambers have been devised.



Fig. 1 (Hallett and Pittler). Acrylic plastic chamber processed around lens and frame of patient's glasses.

Perhaps the most commonly used and probably the simplest and cheapest to make is a cone of washed X-ray film, the base of which is cut to approximate roughly the contour of the face around the eye, which is then attached to the skin and made airtight by strips of adhesive plaster or Scotch tape. The disadvantage of this type of shield and similar commercially made celluloid, glass, or plastic ones is that the adhesive strips inevitably become wet and soiled and loosened so that the air-tight seal is broken. Frequent redressings are therefore necessary, and these usually induce considerable skin irritation.

In the handling recently of two severe cases of herpes simplex corneae, it was decided, as has long been advocated by Lloyd,¹ to make use of a protective shield during the patients' lengthy con-

¹ Lloyd, Ralph I. Personal communication to the authors.

valescences. Being aware of the disadvantages of other types of shields, we found most desirable an acrylic plastic chamber processed around the lens and frame of the patient's glasses (fig. 1). Very accurate air-tight contact with the face is obtained (fig. 2) by working from an impression, similar to that for a dental prosthesis, of the entire orbital and periorbital areas of the face. The end product is durable, light in weight, crystal clear, and rather inconspicuous. It is moisture-proof, easily cleaned, and can be removed and replaced as readily as a pair of ordinary glasses. Droplets of moisture can be seen to form inside the chamber within five minutes after its application. Skin irritation is kept to a minimum by the avoidance of adhesive strips. Any dental technician capable of processing an acrylic denture can easily reproduce this type of chamber.

The first step in the production of the chamber is the preparation of the patient's face for an impression by applying a thin layer of petrolatum to the eyelids, brow, and the periorbital area of the face. The lids are kept closed, and the eye is protected by a small wad of cotton or gauze placed over the lids. The lens is removed from the patient's Government-issue, commercial type, metallic frame spec-



Fig. 2 (Hallett and Pittler). Showing accurate, airtight contact with face.

tacles, and a soft wax is painted on the nose pads and on all parts of the frame that touch, or come very close to, the face. The frame is placed upon the pa-

tient's face, the wax adapted, and, if necessary, more wax is applied. The patient is then told to relax his facial muscles so that the impression will conform to the most normal contour. With the frame in position an impression is taken with an alginate base powder.² An impression tray for holding the material may be made from dental wax. After the material has set for five minutes it is removed from the patient's face.

Dental stone is poured into the impression. After the stone has hardened, the impression material is removed from the stone model and from the frame which remains in position on the stone model. The case is now ready to be waxed.

The base of the wax model is made on the stone model to correspond to the area of contact between the finished appliance and the face. In order to obtain an airtight seal the stone model is scraped to a depth of 2 mm. and a width of 4 to 6 mm. in all areas except that already covered by soft wax where the frame touches, or comes very close to, the face. The rest of the wax-up from the base to the frame is made of a single thickness of dental pink base plate wax, the temple of the frame being kept just clear of the wax.

Upon completion of the wax model, dental stone is poured through the opening in the frame where the lens has been removed. Enough stone should be used to make it flush with the rim of the frame. The temple of the frame is removed and the model is half-flasked by investing it in plaster of Paris. It is then tin-foiled before being full-flasked. After the plaster hardens, the flasks are separated; the wax is removed with boiling water; and the other half of the flask is tin-foiled. Then clear acrylic denture material is pressed into position to take the place of

the wax, and the flask is again closed and boiled for 30 minutes. Upon cooling the case is removed from the flask; the stone and plaster are removed from the appliance; and the latter is cleaned, pumiced, and polished.

To permit the replacement of the lens in the frame, the appliance is cut through cleanly along the line where the temple of the frame will rest against the appliance.



Fig. 3 (Hallett and Pittler). Pinhole glasses fitted tightly and accurately to the face.

The lens and temple are replaced. The cut is sealed by a relining acrylic, which now will also cover the temple, if so desired.

The spectacles are placed on the patient's face. Any poorly approximated areas may be filled in with reline acrylic or ground down, as the case may be. A generally loose fit can usually be remedied by adjusting the fit of the temple around the ear.

A further use for this type of appliance was suggested by the need for pinhole glasses in the postoperative treatment of a case of retinal detachment. The ordinary commercial type of pinholes does not fit accurately to the face and, as a result, permits light leaks to occur. Such leaks may be completely avoided by the accurate apposition of acrylic chambers to the skin around the eyes (fig. 3). The acrylic can easily be made opaque by the addition of a little charcoal powder. The area where the lens is situated in the moist chamber is replaced by acrylic in which the pinhole is drilled upon completion of the appliance. If a large enough flask is obtainable, both pinhole chambers

² We have used Coe-loid powder, a product of Coe Laboratories Inc., Chicago, Illinois.

can be prepared at the same time; otherwise, the nosepiece of the frame can be cut with a separating disc and both halves of the glasses individually prepared and then reunited by soldering the nosepiece.

Further adaptations for and changes in the appliances may suggest themselves in individual cases. To date in our cases they have proved to be most satisfactory.

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SYNTROPAN AS A MYDRIATIC*

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My last report¹ on syntropan in 1942 dealt with several attempts that were made to exclude the burning sensation of syntropan solutions to be used for diagnostic mydriasis. Syntropan (Hoffmann-LaRoche) is the phosphate salt of 3 diethylamine, 2,2 dimethylpropanol tropic acid ester. Its main effect is parasympathetic, and its internal uses are chiefly the same as those of atropine. Its advantages as a mydriatic were then described: the rapid effect; the short duration; no general dangers nor discomforts; no local dangers, as damaging the corneal epithelium, or increasing the intraocular pressure; no delay in returning to work for the patient.

These advantages have been confirmed during the last three years. For lack of time, many patients did not want to wait in the office for dilation for an hour or two, and were inconvenienced by being unable to go back to work immediately after the examination. Strictly speaking, syntropan never irritated the eye, but the burning sensation often caused a flow of tears that delayed the effect of the mydriatic by washing away part of the instilled drops.

Recent developments. The following

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observations result from experiences with more than 300 cases. The exact measurements (ruler or strabometer) of pupillary size have been regularly taken since 1942. All solutions were buffered according to the prescriptions of Gifford.² A solution that was buffered and made isotonic with tears at the same time promised to be most satisfactory. In 1943, a solution was prepared[†] that was based on a recent research of Arrigoni and Fischer³ who postulated that ophthalmologic solutions should be isotonic with tears, and that the pH should be adjusted within narrow limits of the lacrimal fluid, if a nonirritating collyrium was to be prepared (pH of tears about 7.4). But these authors stated that a solution within the pH range of 6.5 to 7.8 was nonirritating, if the collyrium was isotonic. The freezing point of tears was stated to be equivalent to that of a 1-percent solution of sodium chloride, which lowered the freezing point by 0.8°C. Accordingly a 4-percent syntropan solution (sol. no. 7) isotonic with tears was prepared. The freezing-point depression was 0.822°C., close to the requirement. But it was not possible, we were informed, to obtain a stable syntropan solution with a high pH. The pH of this solution, therefore, was 4.33. Even this low figure showed a very slight diminution when the solution was allowed to stand for a month or more. A local pharmaceutical laboratory also stated that it was impossible to have a stable syntropan solution prepared that had the necessary high pH. As this solution was "burning" again, as was anticipated, I returned to previous efforts to make syntropan non-burning, by incorporating an anesthetic.

A new 4-percent solution (sol. no. 8), isotonic with tears and with a pH of 4,

† William T. Strauss, M.D., of the medical department of Hoffmann-LaRoche, was helpful in having this and several other syntropan solutions prepared. For their interest in these tests I wish to thank Dr. Strauss and his co-workers.

that contained 1-percent. holocaine, was prepared and used for half a year. Only the first drop burned, the following drops did not. Mydriasis was satisfactory after 25 to 35 minutes. In dark-complexioned persons its effect was usually delayed for 10 to 15 minutes. For slitlamp examination one or two more drops had to be given, and the period of waiting was slightly extended. But the dilatation was never such that the pupil did not contract with the strong light of the slitlamp (retained light reaction of the pupil with the 4-percent solution).

For these reasons the use of a stronger and more efficient solution was taken under consideration, also the return to a higher pH, if possible. The idea of making the solution isotonic with tears was abandoned to stress the higher pH. A local pharmacy prepared a 6-percent solution (sol. no. 9), and with a pH of 6.6. This solution was more satisfactory. One drop of an anesthetic was instilled before the solution was used, but this was soon abandoned as unnecessary. The desired effect, except in dark-complexioned persons, was faster than with the 4- or 5-percent solution. After two months, the patients began to complain again about burning. Since I knew that the high pH of this solution was dangerous to its stability, its pH was examined and found to have dropped from 6.6 to 6.2. Although this change of 0.4 was small, the figure of 6.2 was lower than 6.5, the limit allowed by Arrigoni and Fischer.³

Recent findings. A new solution was prepared again with a pH of 6.6 and in a 6-percent strength (sol. no. 10). This has now been used for four months and has not lost its stability so far. Its pH will probably go down after a time, as has been the case with all previous solutions. With this restriction the findings are now: (1) A 6-percent solution is better than the previously used weaker solutions. The use of the slitlamp is possible

because the light reaction is negligible. (2) Retinoscopy can now be done to an extent that was previously never considered. The amount of the cycloplegic effect varied between 1 and 2 diopters after one-half to one hour. If there is a doubt about the retinoscopic values, the addition of one more drop of syntropan and waiting a few more minutes make the results more dependable. Previous reports that claimed that syntropan would not affect the accommodation are therefore not exact. Concentrations of 1 or 2 percent never result in any measurable cycloplegia, whereas 4- and 5-percent concentrations do. The 6-percent solutions have a definite and rapid cycloplegic effect, measurable by comparing the lens power at which 14/14 A.M.A. rating print is easily read at near distance. (3) Even the use of five drops of this 6-percent solution had no tension-raising effect (measured with a Schiøtz tonometer). Since I started to use syntropan (in 1934) no glaucoma has been induced by it. It was, however, never used in any case of a suspected or manifest glaucoma. After the cycloplegic properties were found, it was considered not safe enough to press the point as to the nontension-raising properties of syntropan. It probably depends on the concentration whether this effect will be present or not.

Present procedure. (a) Usually a drop of an anesthetic is instilled first. (b) Three to five drops of 6-percent syntropan are instilled at 3- to 5-minute intervals. Each case is handled individually according to the time available, the rapidity of dilation, or the needs (diagnostic mydriasis only, or slitlamp examination also). (c) Routinely, one or two drops of 2-percent pilocarpine are instilled before the patient leaves. This brings the pupil back to its original size within 20 minutes. Fresh solutions burn less than solutions allowed to stand longer. Because of the burning of older solutions, more tearing

results, and with it more syntropan escapes. Thus the loss of time through initial instillation of an anesthetic is compensated by the more intense effect of the syntropan without excessive lacrimation.

Details of the mydriasis. If the interval of three drops given is three minutes each, the mydriatic effect is faster than when the interval is five minutes. The average dilatation following instillation of the 6-percent solution (three drops at intervals of three minutes) is a pupillary diameter of 7 to 8 mm. after 25 to 30 minutes. After 15 minutes the pupil is usually not wider than 4 mm.; 35 to 50 minutes after the first drop, the pupil is dilated 8 to 9 mm. in size.

Synergistic effect of neo-synephrine. When the 2.5-percent ophthalmologic solution of neo-synephrine was introduced, I tried it for diagnostic dilatation. The complaints about burning reminded me of my experiences with syntropan. Therefore, an initial drop of an anesthetic had to be instilled. It had been recommended for synergistic action combined with a cycloplegic. Although it was claimed that the adrenalin-like drugs affect the accommodation too, there was never any proof of it in my experience. There was no cycloplegic effect from neo-synephrine alone in the doses and concentration I used. But as 6-percent syntropan had such an effect, both combined induced both an excellent mydriasis and a certain amount of cycloplegic effect.

The procedure with the combined use

of syntropan and neo-synephrine is now as follows: (a) One initial drop of an anesthetic. (b) After three minutes one drop of neo-synephrine. (c) Continuation with syntropan as described above. In dark-complexioned persons, or if the desired effect of a rapid mydriasis does not take place, each following drop of syntropan is accompanied by one drop of neo-synephrine. The combined use of both drugs hastens the mydriasis, and makes the pupil 1 or 2 mm. larger within the same period of time that syntropan alone would accomplish.

CONCLUSIONS

To the previously mentioned advantages of syntropan as a mydriatic the advantage of using it for retinoscopy in adults may be added. I have recently used stronger solutions than in previous years. The effect of syntropan was proved to be that of a real cycloplegic (which is true of all the members of the atropine group). Therefore, I am now reluctant to recommend it further, in 6-percent concentration, as not dangerous in cases of suspected or manifest glaucoma; in such cases it is definitely contraindicated.

Syntropan is, therefore, an excellent mydriatic. It is recommended that the solutions be renewed from time to time to avoid the change in the value of the pH and the burning sensation connected with this change.

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SOCIETY PROCEEDINGS

EDITED BY DONALD J. LYLE, M.D.

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

April 2, 1945

DR. MILTON L. BERLINER, *presiding*

SYMPOSIUM ON SCREENING METHODS FOR EYE DEFECTS

SCREENING TECHNIQUE FOR EYE DEFECTS IN THE ARMY

MAJOR J. INCIARDI described the administrative and ophthalmologic procedure followed in the determination of ocular fitness for military service as practiced at the Armed Forces Induction Station in New York City. This mass examination is for the purpose of procuring men for military and limited service. A complete scientific ophthalmologic examination could not be performed because of certain limitations as to time, space, and administrative necessity. Overnight stays and hospitalization had to be kept down to a minimum, and it should be emphasized that the ophthalmologic examination is only a small part of the complete examination for which the men are called, and which is done in one day.

The procedure is facilitated by dividing the subjects into two tentative groups, normal and abnormal. The abnormal is selected on the basis of eyeglasses, history of having had eye trouble, statement of poor sight in either eye, and so forth. The normal group comprises about 75 percent of those examined, but only a quarter of the examiners are assigned to this group. The visual acuity is tested at 15 feet on a Navy chart having several lines of 15- and 20-foot letters, the examiner facing the testee. If these are missed, indicating a vision poorer than 15/30, the testee is

shifted to the abnormal group. An external examination is performed. When the ocular rotations are tested, the examiner looks for the edge of a possible contact lens, and for the same reason, he keeps in mind a deep anterior chamber. Ophthalmoscopy is also performed.

The abnormal group is examined for manifest refraction, the poorer eye, as determined by history and the strength of the glasses worn, having its visual acuity determined first. A projector chart is used. Refraction is performed with cycloplegia, if indicated. The objective findings and subjective vision are reconciled. Where there has been an enucleation, the history is recorded. Controversial or borderline cases, where there is diplopia, epiphoria, or questionable malingering, are referred to the head of the department. Two examiners go over all controversial cases. There are fewer malingerers than is customarily believed.

The constancy of the technique is indicated by the day-to-day relative uniformity of the size of the different groups into which the testees are finally divided on the basis of the examination. That few cases unsuited for induction are overlooked and passed is indicated by the very small number of eye defects in men discharged from the Army for preëxisting defects in general.

Discussion. Dr. Morris Davidson pointed out that in the last war 3 percent of the inductees were rejected because of eye defects. Subsequent to induction, 1 percent had to be discharged because of preëxisting defects which had not been discovered. He asked what percentage of defects are overlooked by the technique now used.

Dr. J. J. Fried inquired about the number of cases of squint seen, and how these cases were considered from the viewpoint of induction.

Major Inciardi, in closing, said that statistics are not available to answer these questions directly. There has been a report from an Army hospital in California, where of 7,000 men discharged from the Army because of eye defects, 23 had defects involving the eyes; but it was not stated how many of these were present prior to induction. As the New York City induction station shows the same proportion of rejected and passed candidates as other stations, it may be assumed that it is not overlooking more defects than the others.

As to squint, there were so many qualifications that it was decided not to list strabismus at all except where it was rejectable, and, since for statistics one general diagnosis was made, the figures available do not give a true picture of the number of cases seen. With good vision, up to 30-degree strabismus was acceptable.

TECHNIQUES FOR SCREENING EYE DEFECTS AMONG INDUSTRIAL WORKERS

J. H. COLEMAN, PH.D., discussed screening technique on the basis of the experience at the Sperry Gyroscope plant. Before an appropriate screening procedure can be established for an industrial worker, it must first be known what constitutes a visual defect for him. A formidable difficulty has been that by most arbitrary definitions of eye defects many proficient industrial workers have defective vision, some bad enough to disqualify them on the basis of those definitions. In that event, the quality of the visual fitness of an industrial employee would not appear to be sufficiently important to management to warrant the cost of systematic eye care and study for its employees. This,

however, is as absurd as to think that most industrial workers have the best vision that modern professional knowledge can provide. The facts are the reverse. A high proportion of industrial workers are in need of eye care but do not get it. It pays to maintain the workers' good vision, for their skill becomes greater as they grow older.

In this plant, evidence was found that has convinced management of the worth of a systematic eye-care program by attacking the problem from a different point of view. Assuming that satisfactory workers have the various attributes requisite to performing the job, we set out to learn wherein their visual skills differed from those of the less satisfactory employees on any given job. The tests are performed on the ortho-rater, and the patterns of visual skills for successful workers varied with different types of jobs. This method has not only revealed a marked relationship between visual skills and success on the job but has provided practical standards for screening eye defects. In fact, this method was the foundation upon which a dynamic industrial eye-care program has been built. Standards were set up by which applicants could be selectively placed at jobs in which their vision would give them the greatest likelihood of success, other factors being equal. This method of screening indicated that one fourth of the workers were in need of professional eye care.

Discussion. Dr. Laurance D. Redway indicated that testing for stereopsis is fraught with pitfalls. Many workers, successful on a particular job, will lack the degree of stereopsis accepted as standard. They will have developed some other function to take the place of the stereopsis. Adequate depth perception, permitting the operation of even fine machines, may be found in workers who show some suppression, indicating that there are sub-

stitutes which can be used advantageously.

Miss Edith C. Kerby said that the National Society for the Prevention of Blindness can function in a program of screening through its library facilities and its consultants. She emphasized that the ophthalmologist should bear in mind that a screening process is not diagnostic in nature. The work is done by technicians who have learned to handle an instrument very accurately but are not trained to draw conclusions. The ophthalmologist is needed for guidance and interpretation and should assume a coöperative and understanding attitude toward this work.

Dr. Morris Davidson said that many ophthalmologists are unfamiliar with the term "screening," which is simply another word for sifting, which, in turn, is a means of classification. A group may be broken down into two or more subgroups, but neither a double nor a triple sifting will accomplish anything of value unless it is performed for a purpose—not the sifting itself, but what is done about the findings, is the objective. As had already been indicated, the purpose of the screening is to determine what the individual is visually qualified and prepared to do. Full employment is hoped for after this war, but if everyone is to do a job, the problem is to learn what he can do and whether he has the specific visual requirements for any particular job to which he may be assigned. Although central visual acuity alone has been taken as an index of visual skill, it is not valid to assume that skilled performance is related to visual capacity in terms of visual acuity alone. Moreover, workers acquire their skill with differing degrees of effort, and unless we divide skilled workers in accordance with the years of acquisition of their skill, we may overlook factors other than visual.

Dr. James W. Smith said that if these

tests are to be performed by technicians, the employee should be informed that his eyes are being tested only for job placement and skill, and the test should not be regarded as a medical eye examination. Many workers might pass this battery of tests despite the presence of a pathologic eye condition which they might then neglect, having been assured their eyes are "all right."

Dr. Coleman said that the ortho-rater, the instrument used for his tests, determines the visual acuity of each eye separately and together, depth perception, vertical and lateral phorias, and color perception, at the near and far distances. The instrument is portable and can be taken into the factory or wherever desired, an important consideration to keep to a minimum the time the worker is off his job. It takes about seven minutes to test a single employee.

Dr. Percy H. Fridenberg said that screening alone is just a little corner, one detail among many in the field of ophthalmology applied to industry; that Dr. Coleman had brought out an important point in stressing visual skill as something more than the ability to read a certain line on a test chart at a given distance. Total fitness is what we want to determine, and this involves many ocular as well as "extraocular" functions; namely, color vision (of prime importance in many pursuits), depth perception, prompt and accurate reaction, and correct response to the visual stimulus. The tactile sense may greatly aid or even supplant defective vision in such near work as measurement of tolerances and screening (that is, sifting) minor defects of material. Concentration in the act of seeing may not be susceptible to quantitative measurement but is of great importance. Here, as in so many other activities, experience is a factor, and performance tests will take the place of many purely functional examinations. All

this is part and parcel of our machine age, the rapid and increasing progress of technology, and the mechanization of industry that has revolutionized the processes of production, especially inspection measurements and the automatic elimination of substandard parts. This mechanization, it need hardly be pointed out, finds perhaps its most striking expression in war, not only in combat, but in logistics, transportation, spotting, range-finding, and reconnaissance by a number of specialized photographic and photoelectric processes. In aviation, the speed of up-to-date planes and of the latest weapons—rockets and self-propelled bombs—is so great that the eye cannot pick up, to say nothing of following, the flying target. As this speed approaches that of sound, the noise of the enemy engines does not reach the "spotter" as a warning signal but is more often a death notice, after the damage has been done. Complicated calculations are required for range finding, aiming, and firing, taking into consideration the many variable factors involved, and all this is now done by remote control by an apparatus which does the seeing as well as the split-second thinking. The eye has been relieved of many duties, but other important ones remain.

MASS EXAMINATION OF SCHOOL CHILDREN

DR. MOSES FREIBERGER said that the Department of Health of New York City established its first eye clinic to service the school child 28 years ago. An average of 10,000 new cases is now seen annually. An analysis of the statistical data obtained is outside the scope of this presentation. Every child has a vision test before entering school; and twice yearly thereafter the teacher tests his vision again. In one study, the accuracy of the teachers was checked, and it was found that they were accurate in 95 percent of the cases with a

visual acuity of 20/50 or poorer. With vision of 20/40 or better the teachers were correct in only half the cases. The latter cases are retested by the school nurse. Children with vision of 20/40 or worse, or with eye symptoms, are referred to the ophthalmologist.

In the Department of Health Eye Clinics, the doctor records the visual acuity, muscle balance, color test, and any other external findings. The nurse then instills a 2-percent solution of homatropine, although it is realized that atropine is a better cycloplegic. Certain experiences with the latter, which must be instilled at home, led to its discontinuance for the mass testing. Retinoscopic findings and any ophthalmoscopic abnormalities are now recorded. Eyeglasses, if needed, are prescribed at the postcycloplegic test. A return visit is required to check the glasses, and a periodic return every six months or a year is required for the remainder of the child's school life.

The Board of Education maintains 102 sight-conservation classes to which children with corrected vision in each eye of 20/50 or worse are recommended, as are also children with myopia of a reasonably high degree. The teachers are specially trained and have taken a prescribed course in ophthalmology. The classrooms are selected to give the best possible lighting advantages, and the desks can be moved during the day for the best light. Books and other reading matter are printed in large, bold type, and the teacher writes on the blackboard in letters approaching the 20/200 Snellen line. No home work is permitted. The children are kept in the sight-conservation class only for reading and writing and return to their regular classes for other work. There has been much discussion pro and con regarding the value of these classes in conserving sight. The problem as to whether they will prevent progression of

the myopia is as yet unsolved.

Over 4 percent of the new cases seen in the clinics have heterotropia remaining unimproved after refractive errors have been corrected. There is an equal number of cases of amblyopia ex anopsia. Occlusion of the good eye has been advised for years in the latter group, with very unsatisfactory results. During the past two years, enforced patching for five hours daily, in school where it could be observed, has been done. The results, as compared with a control, unpatched group, do not seem promising. There has been no experience with mass orthoptic training. The time element is the greatest problem and obstacle. An attempt is being made to interest the Board of Education to install an instrument for orthoptics in each sight-conservation classroom; the teacher to supervise the training after she has been given instruction as a technician.

Some ophthalmologists believe that the preschool child deserves a complete eye examination. Several attempts have been made to develop screening procedures to select those most in need of care. Recently, play techniques have been developed to secure greater coöperation by the children. At the present time a study is in progress in the eye clinics to evaluate this screening device and its feasibility for widespread use. The coöperation of these young children is amazing. They should be kept apart and noise should be avoided. If one of these children cries, the whole group will cry.

While these methods of mass testing have been satisfactory in general, many children have visual defects which go undetected. Just as we urge the general population to have chest X rays, we should urge them to have complete ophthalmologic examinations, particularly at the preschool age, when the greatest possibility of prevention exists. Pending this

semimillennium, screening methods should be improved by constant review.

Discussion. Dr. Percy Fridenberg said there should be periodic visual tests at higher-age levels. This is of practical importance in giving high-school youngsters useful information on the choice of an occupation for which they are visually fitted and will save them from entering occupational dead-ends. Previous periodic examinations and records become of medicolegal value in compensation cases and civil or criminal suits, giving evidence, for example, that defective vision claimed as a result of injury was present long before such injury was sustained.

Leon H. Ehrlich,
Secretary.

CHICAGO OPHTHALMOLOGICAL SOCIETY

April 16, 1945

DR. SAMUEL J. MEYER, *president*

PRENATAL DETACHMENT OF THE RETINA

Dr. Arlington C. Krause presented a paper on this subject.

CLINICAL MEETING

(Presented by the staff of Children's Memorial Hospital)

ECTOPIA LENTIS

DR. ROY O. RISER reported three cases of ectopia lentis.

Case 1. Dorothy V., aged 11½ years, had been referred to the Clinic a year previously because of poor distance vision. She had been treated medically for chorea, extreme nervousness, and undernourishment. She was wearing an old manifest correction of -0.75D. sph. in each eye, and after atropine refraction was given a new correction: O.D. -6.00D. sph. = +0.50D. cyl. ax. 90°;

O.S. -0.50D. sph. \approx +1.50D. cyl. ax. 90°. Her corrected vision was 20/40 in each eye. She was referred to a sight-saving class.

There was a definite tremor of each iris; the pupils measured 2 mm. in size, and the anterior chambers were deeper inferiorly. After dilation of the pupils (to 5 mm.) a tremor of each lens was visible; each was dislocated up and to the right. The near point of accommodation was 9 cm. in each eye with glasses. She had had occasional pain in the right eye but no increase in the intraocular pressure.

Her father wore a correction for myopia and had a faint tremor of the iris of the left eye. His pupils were not dilated at the time of examination. The daughter had long spidery fingers and feet. She wore size 1AAA shoes, which were so wide on her that she could hardly keep them on. She was referred to the orthopedic clinic for confirmation of the opinion of arachnodactylia, and this diagnosis was confirmed in the patient and in her father by Dr. Compere. This, then, is a case of Marfan's syndrome.

Case 2. Philip H., aged five years, was brought to the Clinic in September, 1944, because one eye turned in occasionally and because of repeated falls. The eyes were found to be parallel. There was a tremor of the iris of the right eye; none was found in the left. Skiascopy under atropine was difficult because of the bilateral dislocation of each lens, up and out, almost to the center of the pupils. The visible margin of each lens was slightly flattened (not notched), and the zonular fibers were easily visible. The fundi were normal. Upon postcycloplegic examination, the following correction was ordered: O.D. -6.00D. sph. \approx +5.00D. cyl. ax. 150°; O.S. -7.00D. sph. \approx +5.00D. cyl. ax. 60°, with which vision O.D. was 20/200, J3; O.S. 18/200, J7.

The patient did not respond well to high plus lenses in an effort to use the aphakic pupil. No heart trouble was found.

The Orthopedic Clinic confirmed the impression of arachnodactylia. This in association with the ectopia lentis becomes a case of Marfan's syndrome. Several members of the patient's maternal family have long spidery fingers and toes, and a few have eye trouble. The boy's grandmother had married a second cousin.

Discussion of hereditary traits and other congenital defects associated with arachnodactylia were omitted because of the excellent material already available in the literature. One point was stressed: whereas Burch states that 50 percent of cases of arachnodactylia will be found to have ectopia lentis, a careful study of the other half will pick up a number of cases of poor or erratic accommodation due to defective zonular fibers or incomplete attempts of the lens to become dislocated.

Case 3. Harry M., aged 5½ years, was seen in February, 1945, because he held objects too close to his eyes. Vision was 20/100 in each eye. There was no iridodonesis. The anterior chambers were slightly shallower above than below. After two refractions under atropine and a postcycloplegic test, the following correction was prescribed: O.D. -4.00D. sph. \approx +6.00D. cyl. ax. 135° -vision 20/70, J7 at 4 in.; O.S. -4.00D. sph. \approx +6.00D. cyl. ax. 75° -vision 20/70, J6 at 4 in.

Cycloplegia permitted a view of the lower edge of each lens. The inferior edge of each lens was slightly flattened (not notched) and the zonular fibers were easily seen. No lens opacities were found, and the fundi were normal.

This patient had no arachnodactylia; his case was therefore considered one of congenital bilateral ectopia lentis. The family history disclosed no evidences of arachnodactylia. The boy had a pigeon-breast deformity not present in other

members of the family. His heart was normal.

SYMPATHETIC OPHTHALMIA

DR. R. C. GAMBLE presented the history of C. T., who suffered a penetrating injury of the left eye in October, 1942, at the age of eight years. It was a serious injury. The eye was very painful, and was therefore enucleated on November 12, 1942. On November 19th the right eye was congested, and on November 28th precipitates were seen on the back of the cornea. The patient was given atropine, typhoid antigen H, and diphtheria antitoxin. When he was first seen by Dr. Gamble on December 16th, the right eye was markedly congested; the pupil was about 3 mm. in size; there were no keratitic precipitates. The aqueous was turbid, but the fundus could be seen fairly well and appeared normal. An adrenalin pack was used at once, and the pupil dilated well. Treatment consisted of sulfathiazole, gr. 60 daily, and atropine, 4 times daily.

By January 16, 1943, the eye was almost white; there were a few keratitic precipitates, and vision was 20/20. On March 1, 1943, the sulfathiazole was reduced to gr. 30 daily, but as the eye again became congested the dose was increased to gr. 60 daily. On June 2, 1943, the sulfathiazole was discontinued. The eye was white, there were a few keratitic precipitates, and the vision was 20/15.

On August 24, 1943, a gray area was noted on the nasal side of the disc and below; this was larger by September 19, 1943, and the eye had been congested. Sulfathiazole was therefore ordered again. At this time vision was 20/50. The fundus lesion slowly became larger and more elevated; by February 28, 1944, it had encircled the disc and spread near the macula, at which point there was a hemorrhage. No other areas of infiltra-

tion were seen and the lens and vitreous remained clear.

By March 13, 1944, vision had dropped to 20/100. At this time 300,000 units of penicillin were given intramuscularly. Possibly there was some decrease in the size of the choroidal infiltration, but it did not vanish.

In May, 1944, the patient had another course of penicillin, with a little more decrease in the size of the fundus lesion, and vision improved to 20/50 by August 28, 1944. This was the last time he was seen, as he was killed in an accident shortly thereafter. The ultimate effect of penicillin in this case could therefore not be determined.

During 17 of the 20 months he was under observation, he was taking from 30 to 60 grains of sulfathiazole or 45 grains of sulfamerazine a day. His red count never dropped below 3,650,000, and the white count varied from 11,300 to 5,200. He gained 14 pounds in weight. Sections of the enucleated eye from the Army Medical Museum showed sympathetic ophthalmia.

MEMBRANOUS CATARACT DUE TO RUBELLA IN THE MOTHER

DR. R. C. GAMBLE said that S. S., aged nine years, had had a normal birth, but there was a cataract in each eye. She also had pyloric obstruction. Her mother had had three-day measles during the first month of pregnancy. At the age of six months, when first seen, the eyes of this child were of normal size. There was a membranous cataract in each eye, with a dense central area and a less dense peripheral area. The pupils reacted to light but dilated poorly with atropine. A faint red reflex could be seen through the peripheral part of each lens. She had no heart disease and was normal mentally.

The lens of the right eye was needled three times; that of the left eye was

needled once. The membranous cataracts were very rubbery and moved about with the knife, making it very difficult to achieve an incision.

The last operation was performed on the right eye, with two Ziegler knives used at the same time. This was more effective than when only one was used.

The vision was R.E. 20/100; L.E. 4/200.

CATARACT DUE TO RUBELLA IN THE MOTHER

DR. W. SEGALL presented two cases of cataract due to rubella in the mother.

Case 1. T. S., a white boy, aged 2½ years, was born in December, 1942, at full term, with a birth weight of 6 pounds. He was the first child of a mother who had had German measles in the first few weeks of pregnancy.

Both eyes were smaller than normal. The corneas measured 8 mm. The pupils were 2.5 mm. in size and did not dilate well under atropine. There were bilateral cataracts. Both eyes were needled, and lens remnants were still present, but a good red reflex was visible in both eyes. The child had congenital heart disease. Neurologic examination gave negative findings.

Case 2. B. W., a white boy, born in November, 1941, at full term, weighed 4 pounds at birth. The mother, who had German measles in early pregnancy, has three other healthy children, two older and one younger than the patient. The child's right eye was smaller than normal. The cornea measured about 8 mm. The pupil reacted to light and dilated fairly well with atropine. There was a complete, fairly gray cataract which has not been operated on. The left eye showed no disease. The child was mentally and neurologically normal; there was no heart disease.

In these cases the findings and histories

were practically diagnostic. The affected eye was smaller than normal; the pupil was narrow and did not dilate well on atropine instillation. The cataract was either membranous or complete. So far the typical lamellar type had not been seen. Surgery was not uniformly successful. The children were underdeveloped as a rule; some had congenital heart disease, some were deaf, some had serious neurologic or mental defects and some showed nevi. There is a possibility that some cases with the same etiology show no eye defects.

As a rule, German measles is a very mild disease, and complications are rare except in epidemics, when a few cases of neural complications have been described (in 1935 and 1943). This may be due to a change in the virulence of the infectious agent. The virus injures the embryonic layers before the placental barrier has been established. The higher the oxygen consumption of the tissue the greater its vulnerability. This applies especially to embryonic tissue and explains the damage to the child and not to the mother.

Among 22 cases of congenital cataract, 4, or about 20 percent, had a history of infection of the mother with German measles in early pregnancy. In a number of cases where the etiology was suspected, the mother could not remember having had the disease. Rubella may sometimes run a very mild course, the rash may be missing, and the disease can easily be overlooked.

The probability seems to be great that such an infection in early pregnancy may result in congenital defects. It is important that the mother be informed of the etiology so that she may understand that subsequent children will not be affected in the same manner.

Robert Von der Heydt.

COLLEGE OF PHYSICIANS OF
PHILADELPHIA

SECTION ON OPHTHALMOLOGY

April 19, 1945

DR. WARREN S. REESE, *Chairman*CONSERVATION OF LID MARGINS DURING
BLEPHAROPLASTY

DR. CHARLES A. RANKIN gave a brief generalization of the care and observation of pre- and postoperative and traumatic cases, with special attention to preserving what might remain of the lid margins. After giving a summary of previous knowledge of successful attempts, he presented the history and treatment of a white boy, aged 17 years, who was treated in the Wills Hospital. The mid-half of the upper lid had been blown and cut away by flying metal in a chemical laboratory explosion. Particles of lid margin were found and reunited by dovetailing. Further and complete lid reconstruction by use of skin and mucous-membrane grafts was made. Final result showed a well-conserved, smooth, even lid margin, with no notching or overcorrection, and cilia well placed.

Discussion. Dr. Edmund B. Spaeth said that many of the truisms which Dr. Rankin mentioned at the beginning of his paper are pertinent. It is as important to know when not to operate further as to know when to operate, and what to do.

Esser, Wiener, Wheeler, and others have written much on the conservation of lid margins in ophthalmic plastic work. Elschnig and Snellen both spoke many years ago of the interposition of dovetailing separate flaps. Dr. Spaeth said that as far as he knew, this presentation by Dr. Rankin is the first instance of separate attention to the lid margin, and to that portion of the lid above the margin. It is a procedure which can be

utilized basically in many traumatic lacerations of the lid.

Dr. James Shipman said that this was a case from which all can learn something. If nothing else, all might be stimulated to teach general hospital internes to stay away from wounds of the eyelids that go through the margin. There is no other surgery performed about the eye by the general hospital interne that causes more harm and leads to more plastic surgery later. Fortunately, this case was seen by someone at the start who realized the seriousness of the condition. Much can be done to prevent the necessity of future plastic surgery by instructing the interne in a general hospital to refrain from sewing up eyelids whose laceration goes through the lid margin.

The lid margin is very delicate and irreplaceable. Sometimes it is difficult to preserve the margin, and obtain good alignment.

ANGIOID STREAKS OBSERVED OVER A PERIOD
OF 36 YEARS

DR. WILLIAM ZENTMAYER said that in a case of angioid streaks which he observed for the first time in 1908 and which he has seen at varying intervals since, the last time in May, 1944, there were in the right eye masses of dense pigment of irregular shapes. In some portions of the fundus there was complete atrophy of the choroid. The gray zone which had formerly been present about the papilla had disappeared, and there was no trace of angioid streaks. The papilla was somewhat waxy in appearance.

In the left eye, the general appearance of the fundus was similar to that of the right eye, except that the areas of complete destruction of the choroid were more extensive and there was a denser massing of pigment. Beneath the superior artery there was a vertical lesion about

three disc diameters in length which had the appearance of the lesions seen in circinate retinitis. The papilla was waxy in appearance.

Vision in each eye was 1/60. The patient had suffered a stroke affecting his speech. The systolic blood pressure was 210 mm. Hg.

The condition of angioid streaks is probably due to degeneration of Bruch's membrane in which tears occur, and the hemorrhages result from similar changes in the walls of the blood vessels; all other fundus changes are a part of the syndrome. The association with pseudoxanthoma elasticum occurs with such frequency that it may be assumed that they have a common origin.

SOME FACTORS IN THE EXAMINATION OF ASTIGMATISM

DR. I. S. TASSMAN remarked that certain difficulties are sometimes encountered which are usually concerned with the accurate determining of the kind and amount of astigmatism, and also the exact determination of the axis of the correcting cylinder. Probably for this reason, a great deal of stress is laid on procedures and tests for making these determinations by subjective examination. The examination and correction of any case of ametropia cannot, however, be reduced simply to a single mathematical or mechanical procedure.

Important factors in the examination of the patient include, first, a proper and thorough analysis and evaluation of the subjective symptoms. Such symptoms include, most commonly, headache, dizziness, double vision, and blurring. Whenever these symptoms are mentioned, it should first be determined whether they are the result of, or associated with, a suspected ametropia, and particularly astigmatism.

Hyperopic astigmatism causes more

discomfort than myopic astigmatism, except when of low degree. The amount of accommodative effort employed is an important factor in the production of symptoms in hyperopic astigmatism. It is also an important factor in dealing with cases of convergent strabismus. In the latter, the deviating eye invariably presents a greater amount of hyperopic astigmatism, usually at an oblique axis; whereas in the fixating eye, very little, if any, astigmatism may be present.

In young children with a fairly high hyperopic astigmatism in one eye and but little, if any, astigmatism in the other eye, amblyopia may occur very early, whether or not a deviation is present. In most cases of astigmatism in young children of early school age, such symptoms and complaints may be absent. In older children and in young and middle-aged adults, subjective symptoms resulting from the presence of hyperopic astigmatism are more common. In very old patients who use the eyes only moderately for close work, a considerable degree of astigmatism may be present without troublesome symptoms. The occupation of the patient also bears an important relationship to the presence of symptoms, the accommodation, and also the type of astigmatism present. Young people who do close work constantly, and who have hyperopic astigmatism which requires the use of a great deal of accommodation will usually complain of headache and ocular fatigue.

A cycloplegic should be employed in determining the refraction of all younger patients. In all cases of astigmatism, whether a cycloplegic is employed or not, retinoscopy should be a routine procedure in providing the basic determination of the refractive error and the axis of astigmatism. The best method for this purpose is what is known as cylinder retinoscopy, at one meter. However,

whether by spherical or cylinder retinoscopy, the preliminary determination by this method should not be neglected. In cases of irregular astigmatism with corneal opacities, scissors motions, immature-lens changes, and other changes in the media, difficulties may be encountered in obtaining an accurate result by retinoscopy. In these cases a closer distance is recommended to obtain the best result possible.

In cycloplegic cases, the subjective test should follow the objective, and in average cases, the results should correspond. In young children the result of a careful retinoscopy is more dependable than the result of a subjective test, and is arrived at in a much shorter time. Postcycloplegic examination should follow the cycloplegic tests. This should provide the final result. Here, the cross-cylinder can be employed in some cases as an auxiliary in checking the axis of the cylinder, and the strength of the combination. The astigmatic dial can also be employed as an auxiliary or preliminary test in some selective patients, but it does not eliminate the need for careful retinoscopy in routine practice.

The result obtained by this method together with a consideration of the age, occupation, and accommodation in particular are the combined factors that should determine the best correction possible for the relief of the symptoms.

Discussion. Dr. Alfred Cowan emphasized what Dr. Tassman had said about the procedure that he followed; that is, the procedure of retinoscopy, known as cylinder retinoscopy. This is probably the most accurate objective test that we know of for persons such as children or others for whose relief we have to depend ab-

solutely on objective tests. This is the only procedure available. It is the only way to determine objectively the amount and the axis of the cylinder.

He agreed with Dr. Tassman with one exception; namely, the importance of the subjective examination. He did not think its importance could be overemphasized. After all, for those persons who can take a subject test, this test is all important. No objective test can be conclusive; no matter how well it is done nor by whom. By means of a subjective test one can probably come closest to determining the exact refraction, a refraction that can be proved; namely, by having the patient read the finest type possible with the best glass.

Dr. I. S. Tassman said that the point he wanted to stress was that he thought there is, today, much emphasis placed on subjective tests while other important factors and the objective examination are more or less neglected. As he stated in his essay, the subjective test provides the final result, but there has been a tendency in the past few years, in the examination of many, to underestimate and neglect the objective tests. He also mentioned such factors as the accommodation, age, occupation, and the nature of the symptoms complained of, as important in properly recognizing the nature of the condition present.

Many different types of people are encountered. There are many who can even lead the examiner astray if he is not careful and depends too much on subjective examination, failing to analyze and properly interpret the replies of the patient.

GEORGE F. J. KELLY,
Clerk.

AMERICAN JOURNAL OF OPHTHALMOLOGY

Published Monthly by the Ophthalmic Publishing Company

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AN EVALUATION OF ANISEIKONIA AFTER TWELVE YEARS

About 2,500 patients have been examined in the aniseikonic clinic at Washington University in the past 12 years and eikonic corrections have been ordered for some 1,500 of them. Many of them have been examined ophthalmologically by the writer. So many, in fact, that scarcely a week now passes without at least one returning to report and be rechecked. The writer believes that he is now able to evaluate fairly well this type of examina-

tion, and this article gives his impressions.

That aniseikonia is not an unusual condition seems to be generally accepted, though there is still the occasional commentator who thinks that phorias and not size differences are being recorded in the measurements of aniseikonia. This point of view seems to have lost ground in the last few years, and for purposes of this discussion the fact that aniseikonia exists as such and is measurable with reasonable accuracy and that lenses to correct this, as well as other errors of re-

fraction, can be readily made is a premise in this article.

On two occasions questionnaires have been sent by the writer to patients for whom eikonic glasses have been ordered. In each case, over 100 replies were received. In the first series, no particular attention was paid to the time elapsed between sending the questionnaire and the eikonic examination but, in the second, at least a year had passed. These reports have been published previously. They varied little and are strikingly similar to those from Dartmouth and New York sources. They indicated that approximately 80 percent of patients were moderately helped by the corrections and 50 percent completely relieved of their symptoms.

However, statistics can be interpreted almost as one wishes, and it is my impression that these results are far better than can be attributed to the aniseikonic correction alone. How then are we to account for the benefit undoubtedly obtained?

The primary impression that the examiner has of the patients who have come for the examination through the years is that most of them are neurasthenics. Few come from the local community of even as large a city as Saint Louis; probably not more than 5 percent. What does this mean? Primarily it is apparent that these people have not found satisfaction from the routine refraction available locally to them. Many have consulted a half-dozen ophthalmologists and optometrists and have found no examiner who has had the time, interest, or the necessary qualifications to make a psychiatric study of their cases. Finally, in desperation, some ophthalmologist thinks of aniseikonia and says to himself, "Oh, *there* is something that I haven't tried. Let's send him—or often her—to an aniseikonic clinic. If it doesn't accomplish anything else, it will rid me of this difficult patient for a while,

so I'll pass him on to someone else." Truly aniseikonia is the waste basket of ophthalmology.

One may ask how these neuroses have seized on these patients. Sometimes it originates from over-anxious parents, often from thoughtless eye examiners. I quote from Mary Jane Ward's current best seller, "The Snake Pit" in which the memory of the inmate of the asylum concerning the first visit of an oculist is thus stated: " 'Is there any danger of her losing her sight?' mother asked the doctor. You were ten then. 'Well', said the old coot of a doctor, 'Well,—I don't—think so!' For years you felt as though you were committing a crime if you read anything that was not required. And reading was the only thing you cared much for."

In such a way was this particular child prepared to look for eye troubles all her life. She was, as are many others of unstable nervous systems, made the victim of ill-advised suggestion. A large percentage of the aniseikonic patients we see belong in this neurotic group. Only a little ocular discomfort, burning, smarting, or headache is necessary to convert them into ocular neurasthenics. Every illness, every failure is laid to their eyes. No wonder, if they happen also to be nervously unstable, it is difficult to satisfy them with the usual, and often hasty, ocular examination.

In the group of those helped are those with whom the ophthalmologist versed in psychiatry has taken time to talk over their cases most carefully and has often been able to point out their neurotic tendencies and show them that much of their disability is of their own making. Such a conference may be a good start toward cure, and, when added to it is a correction for aniseikonia that may be quite minor and no part of their trouble which, however, has been arrived at after

a long trip by the patient and an impressive examination after arrival, these people often get relief. Many of us have more aniseikonia than some of these patients and nevertheless experience no trouble from it, just as small plus spheres may be necessary for some when a like correction is entirely superfluous for others. Many of these patients can later discard the eikonic lenses after making the mental adjustment necessary to comfort. This group is by far the largest of the 80 percent who attain some relief from eikonic corrections. It is composed mostly of those who have taken the smaller corrections. Among them are those whose tests for refraction have been poorly made; perchance, an astigmatic axis badly placed or a hyperphoria overlooked. If such patients do not come from too far away, it has been our practice to return them to the referring doctor with a tactful note and no eikonic correction given. Such would be the usual procedure if the patient had obvious muscle weaknesses that had never been considered or if he had neglected sinusitis. However, many of these conditions are borderline, and eikonic tests are made, and if aniseikonia is found and the patient comes from afar, the prescription is given, but the patient is advised about orthoptics or to have examination of the sinuses. The treatment of any of these pathologic conditions instead of the correction for aniseikonia may be responsible for the relief.

In the last and, I believe, the smallest group, aniseikonia is the only abnormality and is responsible for the symptoms. In general, these patients have the largest amounts of aniseikonia, and those in this group are the most dependent on their corrections. I believe that most of such patients are really optically helped. Often, very often in fact, they are also somewhat neurotic, but their neuroses have the organic basis of aniseikonia, and relieving

this not infrequently cures the neuroses.

From the foregoing analysis, one cannot escape the conclusion that most of those supposed to be helped by eikonic glasses are really helped by something other than these. If this is correct, we must ask the following questions. Should aniseikonia become a routine office practice, should there only be stations in the large centers for such studies, or should eikonic tests be relegated to the limbo of matters better forgotten?

In my opinion, the second course is the best. The cases dependent solely on this correction for comfort are too few to justify its measurement in the doctor's office. It takes too much time, energy, and expense, and the ophthalmologist cannot afford to do it. I discard the idea of total abandonment of the tests because it would be unfair to the small group whose comfort depends on this correction. Hence, I advocate the idea of having a few central stations for these tests. Great care must be taken in their selections, as certain requirements are necessary. First and foremost, there must be a well-trained, especially psychiatrically trained, conscientious ophthalmologist who has ample time for the study of the patient or, in lieu of this, a competent ophthalmologist with a consultant in psychiatry. There should also be a rhinologist available. If the eye physician is not an eikonic technician, obviously one must be supplied. Several days should be allowed for the first examination because here, if ever, a thorough study of the patient is needed. This plan may be medically sound, but is it practical? How can all this be financed? Certainly it will be expensive, but there may be enough wealthy patients to pay for the aniseikonic patients who are poor, since, fortunately, there are fewer neurotics proportionately among the poor; they haven't time for neuroses.

Another precaution is necessary. Treatments that are wrapped up in the care of neurotics may readily become "rackets," and the examination for aniseikonia may fall easily into this class. Hence, only by the use of rare judgment and scrupulous honesty can these patients be wisely handled.

Lawrence T. Post.

A PLEA FOR BETTER INSTRUCTION IN PERIMETRY

In recent months a good deal has been said about the importance of basic sciences in the practice of ophthalmology, and emphasis has been laid upon the necessity of making available the proper instruction in these subjects. At a recent examination held by the American Board of Ophthalmology this need was further emphasized by the appalling number of candidates who failed in perimetry.

There can be little doubt of the diagnostic value of defects of the visual fields. In the diagnosis of prechiasmal and chiasmal lesions, as well as in lesions affecting the optic tract and radiations, the visual fields are of immense diagnostic value to the internist and the neurologist.

In addition to peripheral-field studies as charted with the perimeter, the study of the central fields of vision as carried out on the tangent screen is most important in the proper diagnosis of a number of important diseases. Often the course of the disease can be determined only on the tangent screen.

In the various types of prechiasmal optic-nerve lesions, such as optic neuritis and retrobulbar neuritis, the central fields explain the diminution or loss of central vision and often make the diagnosis.

In chronic glaucoma, perimetry is of the greatest importance. It is the only means by which the degree of damage can be determined in the early stages of

the disease and is the only method by which the course of the disease may be followed and the treatment evaluated. As is well known, the early field changes are nerve-fiber-bundle defects producing characteristic defects in the central 20 degrees of the field. The tangent field is the most delicate of the perimetric methods and will detect the earliest changes. These defects develop into the various scotomata such as the Seidel scotoma, the Bjerrum scotoma, or Rønne's nasal step, all being merely manifestations of a nerve-fiber-bundle defect or so-called arcuate scotomas. That there may be many variations is self-evident to one familiar with the cause behind the production of these defects.

Even earlier than the scotomas there may be general depression in the field of vision as determined by small visual angles. The depression may not be constant in the very early cases. The initial rise of tension is usually transitory, so that defects disappear when the tension is lowered. This depression may precede, accompany, or follow the appearance of the scotomas. In angioscotometry the earliest sign is a slight enlargement of the vessel shadows with enlargement of the blind spot.

The ophthalmoscopic diagnosis of the early glaucomatous cup may not be easy. The tension varies during the day, and, when seen, the patient may have a normal tension even though early field changes are present. In addition, a large physiologic cup, a senile cup, a myopic disc, and certain types of congenital anomalies of the disc such as staphyloma verum peripapillare or a congenital excavation, may all suggest glaucoma. Often it is the very carefully done perimetric field studies that make the final diagnosis.

From what has been said it is self-evident that the ophthalmologist must not only have a thorough knowledge of the

neuroanatomy of the eye but must also understand thoroughly the course of the nerve fibers in the retina. In addition, the ophthalmologist must have charted enough fields to have learned the pitfalls to avoid in this examination and must never forget that it is a subjective examination. He must also have done sufficient perimetry to learn to appreciate the many variations that may occur in the diseases that produce field changes. A great deal can be learned from the standard books on the subject, but it requires the supervision of a teacher to see that the proper technique is learned. Left to his own devices the student may develop habits that distort and render inaccurate his findings.

In the recent American Board of Ophthalmology examination it was apparent that most of the candidates did not know their neuroanatomy and therefore had difficulty in locating cerebral lesions from perimetric field defects. Many of them had a very hazy idea of the course of the nerve fibers on the retina and were unable to demonstrate the course of the field changes in a nerve-fiber-bundle lesion. Depression of the field of vision was an unheard-of term to some of the candidates. In addition, questioning elicited the information that many of the candidates had actually made very few field studies. It must be admitted that the taking of a visual field often is a difficult and tedious task, and yet that field may be an important link in the diagnosis of a condition of grave concern to the patient. Therefore, if the field is to be of any value it must not only be properly taken, it must also be properly interpreted. In order to do this it is necessary that the student have the theoretical knowledge supported by sufficient experience in perimetry to enable him properly to interpret the patient's reactions in the process of obtaining that field.

The fault is not entirely that of the

student. In too many institutions the taking of the fields is left to a technician who looks upon it merely as a "job" and is not interested in teaching the resident the proper methods to be employed. It is essential that the men responsible for the training of ophthalmologists realize their responsibility in the instruction in this method of examination. It must be admitted that during the war the doctors were so overworked that in many places it became necessary to neglect the teaching of what residents the institution had. Perhaps this accounts for the glaring defect in training noted in the recent examination. It is earnestly hoped that the proper teaching of perimetry will receive the attention it so justly deserves in the development of the "safe ophthalmologist."

Frederick C. Cordes.

THE EYE BANK FOR SIGHT RESTORATION, INC.

After a year of difficulties, and achievement in spite of these, the Eye Bank has become firmly established and is fulfilling its most important function. This is the collection and distribution of eyes, the corneas of which are to be used as material for the transplantation operation. It makes little difference if the demand for these corneas is small, or that the cases that are suitable for the operation are not numerous, or that the ophthalmic surgeons who are competent to perform the operation are few. There is no question about the need for this service. In these days of crowded hospitals and administrative difficulties, the problem of getting the recipient patient ready and the donor cornea at hand, at one and the same time, would have been one perhaps impossible of solution. This problem, however, is now solved, for all that one needs to do is to get in touch with the

Eye Bank and an eye, sterile and preserved, is immediately shipped by air or messenger within a relatively few hours.

In the past the surgeon has had to wait until he had a suitable donor lined up, or material from a still birth available when needed. When the operation was performed by less than a handful of pioneers (who deserve and receive great credit for their contributions) working in very large communities, this problem was not too difficult. Now, however, more and more ophthalmic surgeons are competent to do this type of surgery, and many more are becoming trained in its meticulous though relatively simple technique. It is therefore becoming increasingly unnecessary for patients to travel great distances, at considerable expense, in order to have the operation performed. The donor's cornea is made available as near to the patient's domicile as possible.

The planning and management of this successful venture into a new and dramatic field of service have required great foresight and skill. Some opposition to the idea was expected and encountered, but gradually this has subsided, and now the venture is met on most sides by good will and active participation. The promoters of the idea would prefer to remain in the background and let the scheme speak eloquently for itself. But it is only right to let those interested know that the plan was conceived by Dr. R. Townley Paton and ably promoted and executed by Mrs. Breckinridge, the executive-director of the Eye Bank, both of New York. The American Red Cross and the airlines loyally contribute their services without which the plan would collapse.

The legal incorporation of the Eye Bank for Sight Restoration in the State of New York tidies up the matter in a most efficient fashion. The Certificate of Incorporation, filed February 21, 1945, includes, among many important stipula-

tions having to do with the main function of the Corporation, several paragraphs of great interest and importance. Two of these are quoted here:

"To carry on, directly or indirectly, such research, experimentation, etc., as may be reasonably calculated to be of value in saving, restoring, aiding or preserving eyesight or in helping to prevent or avoid blindness or impairment of vision of any sort or to ameliorate the condition of the blind or those with defective eyesight; to maintain laboratories, clearing houses of information and the like for this purpose. . . . To aid, freely and voluntarily, in any manner which may be permitted by law, by loan, guaranty, grant, scholarship, fellowship, subsidy or otherwise, any corporation or association or any surgeon, physician, scientist or student engaged in saving, restoring, aiding, helping to prevent or avoid blindness, or in whose work or welfare the corporation may have any other lawful interest. . . ."

Thus it is the purpose of the Eye Bank for Sight Restoration, Incorporated, not only to take care of the supply and distribution of corneas but to go further and train young surgeons in the technique of the operation as well as to encourage research studies in the sources, preservation, and handling of the material by laboratories or research workers anywhere.

To carry out this great purpose funds are, of course, needed. The public response to this stimulating and dramatic cause has been, and continues to be, strong and active. As more funds become available, the influences set afoot by the work of the Eye Bank are certain to spread and result in much good to the cause of human welfare.

The training of ophthalmic surgeons is one of the most vital needs of this or any other country. Much has been done in

the past by individuals, and there are many fine organizations successfully engaged in this humanitarian purpose. The developing of skilled, resourceful, and competently trained ophthalmic surgeons has been somewhat casual and restricted. There are too many ophthalmologists doing eye surgery who are not topflight, and patients' eyes have been lost that otherwise, in abler hands, might have been saved. This indictment is less severe now than a few years ago, but there is still much room for improvement. Thus any agency that has for one of its purposes that of training ophthalmic surgeons in further skills should be welcomed, appreciated, and supported. It is time that the attention of the public be directed to the possibility of preventing many cases of blindness through the development and training of competent surgeons, rather than that it be content with supporting the worthy agencies that devote themselves to the care of the patient after blindness becomes an established fact.

Thus it is gratifying to see elsewhere in this issue the announcement of the award by the Eye Bank of seven scholarships to ophthalmologists for training in the technique of the corneal-grafting operation. It means that seven more American ophthalmologists, from various parts of the country, will be trained in further surgical skills.

Regional Branches are needed to complement or augment the work of the National Eye Bank. Such a branch has recently been established in Chicago to serve the Mid West. It is under the direct control of the Chicago Ophthalmological Society through a board of governors composed of the heads of the Departments of Ophthalmology of Northwestern, Illinois, Chicago, and Loyola Universities, and the directors of the eye departments of the Illinois Eye and Ear

Infirmity and Cook County Hospital, all of whom are members of the Society. The branch is physically established in Cook County and is about to function. It receives and distributes eyes from and to hospitals and surgeons in the midwestern area through affiliated groups of hospitals and ophthalmological societies. Surplus material that is not used within 12 to 24 hours is forwarded to New York. Calls on Chicago that cannot be satisfied are referred to New York. Eyes that cannot be used, as well as those the corneas of which have been utilized, are either returned to the sender or kept for microscopic study and report.

The Branch enjoys the support and the legal backing of the Eye Bank itself and in return takes an active part in its great humanitarian purpose. Controlled as it is by the prestige and ethical standing of its board of governors, the Chicago Branch is in a position to control publicity that otherwise can be spectacular, harmful, and unethical, can see to it that the material is wisely dispensed, and is in a strong position to judge the merits of applications for scholarships, fellowships, and so on that may arise within its sphere of influence. As the first Branch to be founded, and because of its high principles, it will serve as a guide to the establishment of further branches in other sections of the country.

It is not the purpose of this editorial to give exact and detailed information regarding the techniques of the Eye Bank. Requests for such information should be directed to the Eye Bank for Sight Restoration, Inc., 210 East 64th Street, New York. Hospitals and the members of local ophthalmological societies are urged to become affiliated with this movement so that more surgeons can obtain more material to make more blind to see.

Derrick Vail.

BOOK NOTICES

OPHTHALMIA . NEONATORUM.

THE PROBLEM AFTER THIRTY YEARS OF STATUTORY NOTIFICATION AND SIXTY YEARS OF CREDE' PROPHYLAXIS. Monograph No. 1 of the Institute of Ophthalmology. By Arnold Sorsby. Paper covers, 65 pages. 10 figures, 15 tables, index. London, published by Hamish Hamilton Ltd., 1945. Price not given.

Sir Allen Daley, Medical Officer of Health, County of London, in his foreword to this excellent monograph, compliments the author for "bringing up to date all the available knowledge, statistical and clinical," concerning the subject. His statement that "the monograph will be invaluable to ophthalmic surgeons, obstetricians, midwives and public health workers" is indeed not open to question.

The author has succeeded in condensing within a relatively few pages a subject that is difficult to handle from a statistical viewpoint. Likewise, it is not easy to discuss succinctly the modern aspects of the prevention, prophylaxis, and treatment of ophthalmia neonatorum within a limited space. Those who are familiar with Sorsby's writings recognize his ability to compress much important information without losing continuity, and this monograph is no exception.

One will find within its pages evidence that while the complications of ophthalmia neonatorum are being rapidly eradicated, the incidence of the disease itself, at least in Great Britain, is no less frequent today than it was possibly 40 years ago. The common organisms, as well as the gonococcus, causing the disease rapidly respond to modern chemo- and, more recently, penicillin therapy, often within a matter of a few hours in the latter event. The widespread beliefs that ophthalmia neonatorum is practically synonymous

with gonococcal ophthalmia and that reliance therefore can be placed on the disinfection of the newborn baby's conjunctival sac are, according to Sorsby, responsible for the fact that ophthalmia neonatorum is not less frequent now than before the newer agents of treatment were discovered. These fallacies should be uprooted. The disease in the mother during pregnancy has been neglected by obstetricians, and Credé's method of prophylaxis, valuable as it is, has been forced in the past, at any rate, to carry more of a burden than it is capable of doing. There remains much to be learned and much to do before this blinding disease is completely eradicated.

If the monograph succeeds in causing us to stop and look and evaluate, it will have done its good work; and medical smugness over the value of the Credé method is due for a fall.

It is hoped that monograph No. 1 is but the beginning of a long line of similarly excellent and noteworthy monographs that we have a right to expect from the newly founded British Institute of Ophthalmology. All ophthalmologists will wish it success and hasten to extend their sincere congratulations to the Institute for its bright future.

Derrick Vail.

A BIBLIOGRAPHY OF VISUAL LITERATURE, 1939-1944. Compiled by John F. Fulton, Phebe M. Hoff, and Henrietta T. Perkins. Clothbound, 117 pages. Springfield, Illinois, Charles C Thomas, 1945. Price \$3.00.

This work is a wartime project produced under the aegis of the Committee on Aviation Medicine, Division of Medical Sciences, National Research Council, acting for the Committee on Medical Re-

search of the OSRD. It is also listed as Publication No. 11, Historical Library of the Yale Medical Library, the work having been done under a contract between OSRD and Yale University.

Articles and books are listed to the number of 3,537 in the standard form by author, with title of paper (or book), name of journal (abbrev.), year, volume number, and page numbers. The classification comprises nine principal group divisions as follows: Anatomy and Ophthalmology, Physiology and Psychology, Visual Examination and Testing (including Methods and Instruments), Correction of Ocular Defects in Military Personnel, Training for Military Specialties (including Optimal Conditions and Procedures, Job Analyses), Ocular Trauma (in Military Services), Goggles and Ocular Protection, Illumination, Visibility. In each of these divisions there are from two to twenty subdivisions, and under many of these are secondary and other subdivisions. The above classification is admittedly arbitrary, but is primarily based on presumed military usefulness. It was devised with the collaboration of a number of eminent high-ranking American and British staff officers, among whom the aviation branches are well represented, and whose names and connections are stated in the Preface.

This bibliography was compiled essentially for military purposes, and accordingly makes no claim to completeness. The effort has been concentrated on the biologic phases, with special emphasis on the literature of psychology, and to the exclusion of aerial photography, optical engineering, and optometry, and, to a large extent, of general ophthalmology and ocular pathology. Notwithstanding all this, there is much material listed in several of the divisions which will be of decided interest and value to the civilian ophthalmologist. The authors are to be

commended for the excellence of their work.

William F. Moncreiff.

JOURNAL OF THE HISTORY OF MEDICINE AND ALLIED SCIENCES. January, 1946, Volume Number 1. George Rosen, editor. Published quarterly by Henry Schuman, New York. Subscription rates, \$7.50 a year in the United States, Canada, and Latin America; \$8.50 in other countries.

If the first number of the *Journal of the History of Medicine* is any indication, the future success of this venture is assured. It is beautifully printed on paper of excellent quality, illustrated profusely with portraits and facsimiles that capture the spirit of former times, and is a credit to the printer's art. The body of the *Journal* thus has great charm. Its contents, however, are what count, and the editor has succeeded in getting together for this, his first issue, 10 outstanding articles of interest to all physicians regardless of their specialties. Subsequent issues are promised that will continue the high quality and variety.

In his introduction the editor points out that he does not want to cultivate medical history as a mere search for antiquities, as a kind of hunt for curios, but rather as a vital, integral part of medicine. He states that he "will not stress the technical aspects of medical history, but will endeavor, while maintaining the highest literary and scholarly standards, to present studies that can be of interest to as large a section of the medical profession as possible."

Those who are interested in the culture of Medicine, and there is every reason to believe that these are not few in number, both here and abroad, will welcome this new *Journal* and wish it success.

Derrick Vail.

OBITUARY

MAX POSER

1870-1946

Dr. Max Poser, special technical representative of Bausch and Lomb Optical Company, died at his home in Rochester, New York, on January 4, 1946. He was born on November 8, 1870, in Jena, Germany. His formal education, under the guidance of Dr. Ernst Abbé, was obtained in the University of Jena, from which he was graduated with the degree of Doctor of Physiological Optics, in March, 1889. He became affiliated with the London Branch of Bausch and Lomb on August 1, 1913, and came to Rochester a year later.

Many years of Dr. Poser's colorful life were spent in consulting with, and assisting, leaders in scientific endeavor. He was considered one of the world's greatest microscopists. The solution to such problems as the control of infection in surgery, malaria, and sleeping sickness received valuable aid from his vast knowledge of optical principles and instruments. His keen insight into the problems of vision contributed to the design of many of the eye-examination instruments, such as the Ives Acuity Apparatus, Stereo Campimeter, and the Poser Slitlamp which are in general use today.

In his later years, Dr. Poser spent most of his time in photomicrography, assisting research professors throughout the United States.

In 1937 he was made a Life Technical Advisor of the American Academy of Ophthalmology and Otolaryngology. He was a member of many scientific societies, including the Royal Institution of Great Britain, British Physical Society, Royal Photographic Society, and held a Fellowship in the Royal Microscopical Society. He was a member of both the Optical Society of Great Britain and America, the American Association for the Advance-

ment of Science, Pan-American Congress of Ophthalmology, American and New York State Optometric Associations, National Society for Prevention of Blind-



ment, and the Franklin Institute. He was an honorary member of Beta Sigma Kappa, serving on the scientific section of the Advisory Board of Research.

The personal and gracious charm of Dr. Poser contributed in no small measure to his popularity with ophthalmologists, among whom he had many friends and admirers. He was such an intimate part of the Bausch and Lomb exhibits at all of the conventions of the ophthalmological societies that it will be difficult to imagine the meetings without him. He was always eager to explain most minutely and patiently the ingenious intricacies of the many scientific optical instruments displayed. He was a master of all of them and a designer of many. The younger men particularly looked on him as a teacher of power and ability. His loss will be felt keenly.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the *Ophthalmic Year Book*. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the *Journal*.

CLASSIFICATION

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| 1. General methods of diagnosis | 10. Retina and vitreous |
| 2. Therapeutics and operations | 11. Optic nerve and toxic amblyopias |
| 3. Physiologic optics, refraction, and color vision | 12. Visual tracts and centers |
| 4. Ocular movements | 13. Eyeball and orbit |
| 5. Conjunctiva | 14. Eyelids and lacrimal apparatus |
| 6. Cornea and sclera | 15. Tumors |
| 7. Uveal tract, sympathetic disease, and aqueous humor | 16. Injuries |
| 8. Glaucoma and ocular tension | 17. Systemic diseases and parasites |
| 9. Crystalline lens | 18. Hygiene, sociology, education, and history |
| | 19. Anatomy, embryology, and comparative ophthalmology |

1

GENERAL METHODS OF DIAGNOSIS

Benton, A. L. A visual retention test for clinical use. *Arch. Neurology and Psychiatry*, 1945, v. 54, Sept., p. 212.

A brief test of visual retentive capacity, available in two equivalent forms, has been developed for use in the mental examinations of patients as a supplement to the auditory-vocal digit-span test.

The test involves sensorimotor components which are different from those involved in performance on the digit-span test; the material to be retained is of a nonsymbolic nature, and performance on the test is relatively insensitive to emotional and tensional influences.

The normative data indicate a close relationship between the visual-retention-test score and the level of general intelligence.

Investigation of the performance of patients with cerebral lesions indicates that the test is of value in defining the scope and severity of intellectual impairment.

Normative scores have been developed on the basis of the standardization data, and a manual of directions for administration and interpretation of the test has been developed.

Theodore M. Shapira.

Bulnes, L. S. The participation of the ophthalmologist in carnio-encephalic injuries. *Arch. de la Asoc. para evitar la Ceguera en Mexico*, 1945, v. 3, p. 31.

The author describes the ocular symptoms common to all head injuries, principally the pupillary changes, papillary edema, and variations in blood pressure in the central artery of the retina, "the magnificent and early sign of intracranial hypertension."

For purposes of further description the author divides the cranium into anterior, middle, and posterior segments, and further subdivides each of them into floor and vault. A comprehensive list of ocular symptoms of great diagnostic value is presented under these divisions.

Jerome B. Thomas.

Epstein, E., and Lesser, S. A. H. A trick test to detect night-blindness "malingerers." *Brit. Med. Jour.*, 1945, Nov. 10, p. 644.

Malingers who claim nightblindness can be detected by determining with the adaptometer the minimal intensity at which red light can be seen. Even if the periphery of the retina is diseased there should be no increase in the minimal intensity at which red light is visible with the cones of the normal macula. If the subject affirms that he sees the red light only when it is bright, he is trapped as a malingerer. This observation has been confirmed in patients who have retinitis pigmentosa, diffuse chorioretinitis, and advanced glaucoma with good macular vision. Severe nutritional deficiency in which the central vision is reduced by vitamin-A deficiency might be the only exception.

R. Grunfeld.

2

THERAPEUTICS AND OPERATIONS

Báthori, Z. Nicotinic acid in ophthalmology. *Klin. M. f. Augenh.*, 1942, v. 108, Nov.-Dec., p. 725.

When nicotinic acid is given intravenously or intramuscularly it causes dilatation of capillaries and precapillaries with reddening of the skin. At the same time it lowers the systolic and diastolic blood pressure. Báthori observed that nicotinic acid also produces a dilatation of the retinal vessels and conveys a better blood supply to the retina and choroid. Five to 10 minutes after injection of at least 50 mg. the vision of patients suffering from pigment degeneration of the retina and from choroiditis improved markedly and the visual field expanded extensively. Nicotinic acid was also used in cases of quinine amblyopia, arterio-

sclerotic retinal disease, and senile macular degeneration. It was usually given in combination with vitamin B₁. In cases of retinitis pigmentosa, choroiditis, retrobulbar neuritis, and angiospasm its effect was often striking. Choroiditis Förster, syphilitic optic atrophy and vernal conjunctivitis were not improved by nicotinic-acid therapy. (17 vision fields.) F. Nelson.

Chamlin, Max. Effect of talc in ocular surgery. *Arch. of Ophth.*, 1945, v. 34, Nov.-Dec., pp. 369-373.

Since rubber gloves have become popular in the operating rooms of many ophthalmic institutions, one is prompted to study the effect on the ocular tissues of the talc powder on these gloves. The talc used in the present study was obtained from the Chas. B. Crystal Co., Inc., who furnished the following quantitative analysis: Silica (magnesium trisilicate), 60.04 percent; aluminum oxide, 1.80 percent; iron oxide, 0.16 percent; calcium oxide, 0.38 percent; magnesium oxide, 30.98 percent; loss on ignition, 6.22 percent.

One series of studies consisted of the withdrawal of varying amounts of aqueous from rabbit eyes and the replacement with similar amounts of suspension of talc of varying concentration in an isotonic solution of sodium chloride. The second series consisted of iridectomies, with irrigation of the anterior chamber with a suspension of talc which was injected between the extraocular muscles and the sclera.

The author demonstrates that talc produces granulomas in the eyes of rabbits. When rubber gloves are used, it is advisable to remove all the talc before operating.

In the recent literature, there has

been a good deal of discussion on substitutes for talc. The two substances most favorably received thus far are potassium bitartrate and hydrolyzed starch.

Before the new powder is adopted for use in surgical procedures, however, it would be well to carry out studies similar to those described with talc.

R. W. Danielson.

Deloge, D. Visual reëducation. *Ophthalmologica*, 1943, v. 105, Feb., pp. 91-105.

The author describes Remy's diploscope. He discusses the advantages of the apparatus and demonstrates why it improves orthoptic training and why it helps to a better understanding of the physiology of vision.

The author, who has worked on visual reëducation since 1905, favors Remy's diploscope because it permits a reduction of the phenomena of the visual process. Furthermore, it makes binocular vision possible in patients who otherwise could not be either improved or cured.

A detailed discussion of the treatment of high anisometropias and aniseikonias is given. The vision in an amblyopic eye improves more rapidly than with monocular occlusion. He also mentions his remarkable success in the treatment of any kind of squint. (1 figure, references.)

Alice R. Deutsch.

Dubois-Poulsen. Penicillin in ophthalmology. *Ann. d'Ocul.*, 1945, v. 178, March, pp. 82-100.

Penicillin is bacteriostatic but can be bacteriocidal and bacteriolytic, and is most active during the invasion stage while bacteria are multiplying. In ophthalmology, its greatest usefulness is in infections due to staphylococci,

hemolytic streptococci, pneumococci, meningococci, gonococci, and *Spirochaeta pallida*. In staphylococcal infections it is twice as effective as the sulphonamides. Resistance to penicillin is less frequent and more slowly acquired than to sulphonamides. Affections of the posterior segment of the eye are best treated by intramuscular or intravenous administration. The former acts more slowly but is retained in the tissues longer. The latter is eliminated in 30 minutes except for 10 percent, which is eliminated within three to four hours. Generally speaking, instillation is used for conjunctivitis, ointments for blepharitis and subconjunctival injection for corneal infections. The solution used for instillation every one to two hours has 1,000 units per 1 c.c. in an isotonic saline solution, pH 7.7, with or without wetting agents such as aerosol. The ointment used has 250 units per 1 c.c. in a base of 25-percent vaseline, and 75-percent cold cream. For subconjunctival injection 1-2 c.c. of solution containing 2,500-5,000 units per c.c. with 2-percent novocaine is used. The last is the most effective. For use in the anterior chamber, 0.4 c.c. aqueous is removed and replaced by a solution containing 500-1,000 units per 1 c.c. Numerous illustrative cases are presented.

Charles A. Bahn.

Jensen, V. A. The use of jod-plaston for testing cataract knives. *Acta Opth.*, 1943, v. 20, pt. 1, pp. 95-96.

Unable to secure chamois skin, the author found a suitable substitute in jod-plaston, a catgut-like animal membrane used for interposition between surfaces in surgery. Ray K. Daily.

Kekcheev, K. K. Methods of accelerating dark adaptation and improv-

ing night vision. War Medicine, 1945, v. 8, Oct., p. 209.

In order to accelerate dark adaptation of the eyes of pursuit pilots the following methods were found useful: The pilot can be housed in moderately illuminated buildings; he must avoid bright light. Wearing goggles with light filters all day long is impracticable under combat conditions because it causes fatigue. The sensitivity of the dark-adapted eye can be increased five to six times if it is exposed to red light. The pilot may use the short period while he is waiting in the cabin of his airplane before his motors are started, to expose his eyes to red light of definite brightness which is turned off immediately before taking off. The instrument panel should be illuminated with weak red light.

The functional capacity of the dark-adapted eye can be increased by direct action on the cortex of the brain by means of pharmacologic substances, such as caffeine. Caffeine increases the minimal-brightness perception, the contrast sensitivity, and the depth perception and lowers the threshold of differentiation. The caffeine effect appears half an hour after the drug is given and lasts for $1\frac{1}{2}$ hours.

Weak and brief excitations of any sense organ—such as, sounds of low intensity, low concentration of gustatory and olfactory stimulants, or light muscular work—raise the sensitivity of the dark-adapted eye, whereas strong, and prolonged stimulation usually lower its sensitivity. Simultaneous action of two excitants combine their effect on night vision. Gustatory stimulants (sugar, table salt, and organic acids) or olfactory stimulants (geraniol and oil of bergamot) in definite dosages, increase the sensitivity of the dark-adapted eye.

Diminution of visual acuity and color vision at high altitude is caused by anoxemia and can be combated by the administration of oxygen. Up to the level of 3,000 feet the anoxemia can be relieved by the intake of relatively large doses of dextrose.

R. Grunfeld.

Leinfelder, P. J. and Paul, W. D. Oral penicillin in ocular inflammation. Amer. Jour. Ophth., 1946, v. 29, April, pp. 450-451. (1 table, references.)

Lijó Pavia, J., and Lachman, R. Penicillin and metastatic endophthalmitis. Rev. Oto-Neuro-Oft., 1945, v. 20, March-April-May, pp. 29-34.

The authors quote Chester S. Keefer's list of diseases amenable to penicillin therapy, especially the sulfar-resistant conditions. In ophthalmology, penicillin is of great help in such conditions as acute and chronic blepharitis, acute conjunctivitis, infected corneal ulcers, dacryocystitis, hordeolum, and recurrent chalazion and prophylactically after injuries. A collyrium of 250 to 500 units per cubic centimeter, and an ointment containing 30-100 units per gram, are employed topically. There is minimal local reaction to the drug and vehicle. For endocular and retrobulbar infections the drug is administered intravenously.

A middle-aged diabetic patient with cachexia and pulmonary disease is described, who developed sudden blindness of the right eye due to uveitis with hypopyon. Sulfonamide therapy was instituted and atropine was instilled. A characteristic endogenous endophthalmitis with a typical vitreous abscess supervened. Penicillin was given and after two days the eye was considerably improved. After 400,000 units had been administered the inflamma-

tion had subsided but the pupil remained secluded. The authors conclude that penicillin therapy should be instituted at the first sign of severe intra-ocular infection. (References.)

Edward Saskin.

Parry, T. G. W., Laszlo, G. C., and Penistan, J. L. *Penicillin in ophthalmology*. *Brit. Jour. Ophth.*, 1945, v. 29, Sept., pp. 479-485.

The experiences of the authors in the use of penicillin in a country hospital are presented.

Solutions of more than 100 units per cubic centimeter retained their potency for many weeks in the refrigerator and for at least a fortnight at room temperature.

Solutions were applied as follows:

(a) In acute conjunctivitis with secondary corneal ulcers, instillations of penicillin (250-500 units per cubic centimeter) into the conjunctival sac were made every two hours during the day and night for 72 hours and after this period, during the day only. Signs of improvement were observed after two or three days with complete cure in five to seven days.

(b) In four cases of serpent ulcer of the cornea instillations of a solution of 1,000 units per cubic centimeter were made into the conjunctival sac. The solution was instilled every two hours during the day and night for five or six days and then continued in the daytime only. The treatment was combined with irrigation of the lacrimal passages with a solution of 250 units per cubic centimeter twice daily. Cure was obtained in 10 to 14 days. Hypopyon was present in all cases.

Two cases of gonococcal ophthalmia were treated in a similar manner. All discharge of pus ceased in three days, and complete cure ensued in one week.

There was no corneal involvement in either case.

(c) A concentrated solution of penicillin was used in a case of penetrating wound of the sclera before it was sutured. The wound healed in five days without any evidence of infection; but a low-grade iritis supervened, and the eye was removed, owing to the risk of sympathetic ophthalmia.

Two cases of endophthalmitis, one, a part of a pneumococcal pyemia and the other a perforating injury previously treated outside the hospital, were treated with penicillin solution. In the first case, that of a patient aged 78 years, 10,000 units per cubic centimeter were applied to the anterior chamber through a keratome incision on two successive days. Then systemic penicillin was used; but hypostatic pneumonia developed, and the patient died. The eyeball was full of pus.

The second patient had three applications of 20,000 units per cubic centimeter of penicillin installed into the anterior chamber. He was also given an intravenous injection of T.A.B. vaccine. The hypopyon was syringed out of the anterior chamber with the penicillin solution but enough of the solution was left to maintain the anterior chamber. Complete cure was obtained in ten days.

(d) Injection into the tissues was carried out in all cases of acute dacryocystitis where there was no definite abscess formation and in cases of minor suppurative lid affections. Solutions of 1,000 units per cubic centimeter were used, and cures were obtained in 24 to 48 hours. This method should be applied only after injection of two to four percent novocaine without adrenalin.

(e) Irrigation with a solution of 250 units per cubic centimeter of penicillin in the aftertreatment of an abscessed

dacryocystitis after the abscess had been opened.

Creams. The application of cream seems to be the only satisfactory method for out-patient treatment. A standard strength of 250 units per gram in a 4-gram tube can be kept at room temperature for a period of about three weeks.

Typical cases in which penicillin cream was used are as follows: (1) Acute conjunctivitis with or without corneal ulcers; (2) marked ectropion with severe chronic infection of the conjunctiva; (3) blepharitis; (4) recurrent styas; (5) eversion of the lacrimal punctum.

In acute conjunctivitis complete cure was obtained in eight to twelve days with application of penicillin cream in the conjunctival sac every four hours. Improvement occurred after the third day.

Recurrent styas respond excellently to penicillin treatment.

Interrupted treatment was most satisfactory in cases of chronic blepharitis. Application was used three times daily at first and after a 10-day interval twice daily.

Two patients with hypopyon ulcer who refused hospitalization were treated with penicillin cream at intervals of three hours. Both were cured in three weeks.

Powders of 2,000-units-per-gram potency were used in some cases of corneal ulcer and acute dacryocystitis after incision. Penicillin powder applied to the conjunctival sac is a very satisfactory method of treating torpid ulcers. (References.)

Edna M. Reynolds.

Reeves, R. J. Roentgenotherapy and radiotherapy for lesions about the eye. *Rev. Oto-Neuro-Oft.*, 1945, v. 20, Sept.-Oct., pp. 120-123.

Roentgenotherapy and radiotherapy for lesions about the eye are always attended by some danger. Beta rays and mild X rays are most easily used, because their penetration is superficial. Corneal ulcers, vernal catarrh, recurrent pterygium, angiomas, tuberculous kerato-iritis, blepharitis, chronic conjunctivitis, epitheliomas, and lymphomas, are responsive to this type of treatment.

Vernal catarrh has been treated with a one-half erythema dose every two weeks, following the application of a local anesthesia, with satisfactory results. Chronic blepharitis is given 100 to 150 r weekly, for four or five doses. Fresh corneal scars respond to less-than-erythema doses over a long period of treatment. Tuberculosis of the anterior segment of the eye responds favorably to small doses of X rays or beta rays. Corneal epitheliomas are occasionally radio-sensitive. Epitheliomas of the lid should be excised and the area exposed to beta rays or mild X rays. Lymphoma or angioma may be similarly treated. Coöperation between radiologist and ophthalmologist is essential. Edward Saskin.

Town, A. E., Frisbee, F. C., and Wisda, J. G. Penicillin control of ocular infection. *Amer. Jour. Ophth.*, 1946, v. 29, March, pp. 341-345. (2 tables, references.)

3

PHYSIOLOGIC OPTICS, REFRACTION, AND COLOR VISION

Bender, M. B. Polyopia and monocular diplopia of cerebral origin. *Arch. Neurol. and Psych.*, 1945, Nov.-Dec., p. 323.

This very difficult article describes in detail the symptoms, physiology, and pathology of polyopia and monocular diplopia. Four illustrative case reports

are presented in detail. The polyopia is due indirectly to imperfect fixation which, in turn, is due to defective macular vision. The difficulty of fixation further stimulates formation of new maculas, and in attempting to fixate, the eyes are involved in increasing amplitudes of excursion. This increase in ocular movement causes almost simultaneous stimulation of the new macular areas with the resultant polyopia.

Morris Kaplan.

Bernstein, F., and Bernstein, M. Law of physiologic aging as derived from long range data on refraction of the human eye. *Arch. of Ophth.*, 1945, v. 34, Nov.-Dec., pp. 378-388.

As reported in earlier publications by Bernstein and his collaborators, Hiedemann and Steinhaus, a statistical correlation exists between presbyopia, as measured by the gradual loss of power of accommodation, and the length of life.

From the files of Dr. John E. Weeks, former head of the department of ophthalmology of New York University, 3,000 cases were selected, in which the development of refraction and the changes in prescriptions could be followed through periods ranging from six years to over 40 years, covering ages from 35 years to the highest calendar ages. From these 3,000 cases were selected 344 in which presbyopia had been present more than 12 years and 6 or more prescriptions had been given. In none of these cases were there any pathologic traits nor more than 1.5D. of myopia; in all visual acuity was 20/20 by the Snellen test.

The authors present learned and technical conclusions, which are difficult to abstract. R. W. Danielson.

Burian, H. M., Walsh, R., and Bannon, R. E. Incidence of significant

aniseikonia. *Amer. Jour. Ophth.*, 1946, v. 29, Feb., pp. 201-203. (1 table, references.)

Carlesberg, Olof. Pathogenesis of sulfonamide myopia. *Acta Ophth.*, 1942, v. 20, pts. 2-4, pp. 275-292.

A detailed report is given of four carefully studied patients. The author concludes that the myopia is due to changes in the lens, and not to ciliary spasm. The range of accommodation was normal. The depth of the anterior chamber, diminished in all cases, is attributed to a swelling of the lens. A slight rise in intraocular pressure is also interpreted as a sign of increased volume of the lens. The three eyes examined after instillation of a mydriatic gave no indication of a relaxation of a spasm of the accommodation. In one case a negative spherical aberration was found after homatropine instillation, and in another case a positive spherical aberration appeared as the drug-induced myopia cleared. The seat of the lens changes is predominantly the lens nucleus. Ray K. Daily.

Fieandt, Olof. A case of sulfanilamide myopia, and an investigation of its pathogenesis. *Acta Ophth.*, 1942, v. 20, pt. 1, pp. 24-39.

A review of the literature and a report of a 23-year-old student nurse who developed a transitory myopia after the ingestion of 0.5 gm. of sulfanilamide is presented. Interested in elucidating the pathogenesis of the process, the author made careful studies of the refraction and the range of accommodation while the myopia was clearing. He also determined the effect of homatropine and eserine on the refraction and accommodation. Since the patient had to take another dose of sulfanilamide, the author decided to utilize this opportunity for research. A careful

study of her refraction, fields, and tension preceded the sulfanilamide ingestion. Then the right eye was atropinized and the left eye used as a control. After the ingestion of the drugs the refraction, range of accommodation, and the effect of eserine and homatropine were studied during a period of four days, at the end of which the refraction returned to normal. The data show that myopia appeared in both eyes, but more slowly and less profoundly in the atropinized eye, and that the effect of atropine on the accommodation was not parallel to its effect on the refraction. It appears, therefore, that sulfanilamide counteracted in part the paralyzing effect of atropine on the ciliary muscle. In the light of Tscherning's theory of accommodation, the myopia may be accounted for by a ciliary spasm. To conform with Helmholtz's theory of accommodation, the disparity of the effect of atropine on the refraction and on the accommodation can be explained only by changes in the lens itself, in addition to ciliary spasm.

Ray K. Daily.

Gyoerffy, S. **Experiences with unbreakable contact lenses.** *Ophthalmologica*, 1944, v. 108, July-Aug., pp. 44-67.

One hundred consecutive patients who were fitted by the author with unbreakable contact lenses made from artificial resins in the university eye clinic in Budapest were questioned as to their experiences in wearing these lenses. Forty-seven patients wore the lenses for high degrees of myopia, 25 for keratoconus, and 28 for other refractive errors. Seventeen of the patients did not wear their lenses, and 17 others wore them only on rare occasions. Of the 66 patients who wore their contact lenses regularly or often, 5 were able to wear them four hours

consecutively, 41 wore them from four to 10 hours, while 20 patients could wear them longer than 10 hours. Some had to change the fluid during the periods mentioned. The author discusses the disturbances that are connected with the wearing of contact lenses: fogging due to haziness of the corneal epithelium, formation of bubbles, photophobia, and seborrheic deposits on the surface of resin contact lenses. With the author's technique, no molds are taken from the eyeball of the patient. A set of 50 model forms is used and the form that fits most closely the shape of the individual eye is used for the manufacturing of the final contact lens.

Max Hirschfelder.

Hall, Ronald. **Word blindness: Its cause and cure.** *Brit. Jour. Ophth.*, 1945, v. 29, Sept., pp. 467-472.

The author's interest in the cause and cure of word blindness is more than merely academic since he himself suffered from word blindness as a child and was unable to read until 15 years of age. He learned to read by breaking down all words into their smallest parts and then synthesizing them again by association.

If the patient has difficulty in recognizing single letters, the interaction of tactual and visual perception can be utilized by supplying raised letters. Association can be used by having pictures of objects in the form of letters; for example, a snake forming the letter S. Then when all the letters are known, two-letter words should be learned. He should then read passages in books, picking out all the known two-letter groups such as those underlined in "Now this is the best method." This is a form of analytic vision which will gradually extend synthetic vision so that it will absorb longer words after they have been broken down.

When all two-letter words have been thoroughly mastered in this way, the same procedure should be followed with three-letter words and then with four-letter words in order gradually to extend synthetic vision. When two-, three- and four-letter words have been thoroughly mastered, the important two- and three-letter limbs of words, which are not themselves actually words, should be learned and then passages in books should be read by picking these words out; for example, -ly, -ed, -ing.

The author believes that word-blind children are slightly hyperthyroid, at least until puberty.

Edna M. Reynolds.

Pascal, J. I. Cardinal points in the static and in the dynamic eye. *Arch. of Ophth.*, 1945, v. 34, Oct., pp. 319-320.

As a means of remembering the relative distances between the cardinal points of the eye, the author uses the benzene ring. Starting at the top of the ring and proceeding clockwise the points are designated as focal point 1, nodal point 1, nodal point 2, focal point 2, principal point 2 and principal point 1. Any two opposite sides that are parallel are equal. The distance between the principal point and the corresponding nodal point is equal to the radius of the single refracting surface that can replace the whole ocular system. This potential radius is equal to the difference between the principal focal lengths.

When the eye accommodates it becomes a stronger optical system. This causes a displacement of all the cardinal points. This shift in cardinal points can be visualized and easily remembered by utilizing another benzene ring inside the original ring. This is a thinner and longer ring.

John C. Long.

Weekers, R., and Russell, F. A new ocular test for nutritional deficiency. *Presse Méd.*, 1945, No. 48, Dec. 1, p. 656.

The authors review the role of vitamin A in dark adaptation and point out that avitaminosis A is a cause of night blindness which is reversible on administration of the vitamin. However, it has not been possible to show a close relationship between the level of the carotinemia and the quality of night vision.

In the course of investigations on perimetry in reduced illumination, the authors discovered a retinal phenomenon closely related to that of dark adaptation. They noted that progressive enlargement of the visual field measured under low illumination, as related to the duration of the exposure to darkness, permits a measurement of the retinal adaptation, particularly the adaptation of the rods. They also noted that contraction of the visual field measured under low illumination constitutes a sensitive and precise quantitative test of night blindness. They found that certain nutritional deficiencies, particularly those involving the proteins and the lipids, produced a concentric contraction of the visual field as measured under low illumination. They suggest that this contraction of the visual field is probably due to an alteration in the metabolism of visual purple, but they are unable to conclude that this alteration results from a simple avitaminosis A.

Phillips Thygeson.

4

OCULAR MOVEMENTS

DeJong, R. N. Nystagmus, an appraisal and classification. *Arch. Neurol. and Psych.*, 1946, v. 55, January, p. 43.

The author gives an up-to-date de-

scription of nystagmus and a classification of nystagmus according to its origin. R. Grunfeld.

Devic, Paufigue, *et al.* **The syndrome of Parinaud, an anatomico-clinical study.** *Ann. d'Ocul.*, 1945, v. 178, May, pp. 177-199.

This syndrome includes paralysis of binocular vertical movements and always involves the superior part of the cerebral peduncles. The lesion may be small and extremely limited. Depending on the location of the lesion in the white commissure posteriorly or the juxtacommissural region, it is bilateral and symmetrical or unilateral and asymmetrical. A man, aged 37 years, who had received a bullet wound in the left temple some 20 years previously, developed a Weber syndrome (right hemiplegia and left third-nerve paralysis) with Parinaud's syndrome. Lateral eye movements were normal. The vision in the right eye was 20/30 and in the left eye, 20/20. Brain sections showed the expected lesion. (8 figures, references.) Charles A. Bahn.

Dupuy-Dutemps, L. and P. **The function of convergence in concomitant strabismus.** *Ann. d'Ocul.*, 1942, v. 178, No. 2, pp. 49-55.

In a study of more than 200 cases of strabismus, convergence was measured by comparing the deviation for distance and near with a perimeter. In convergent strabismus normal convergence was present in 70 percent, diminished convergence in 20 percent, and no convergence in 10 percent. In divergent strabismus normal convergence was present in 42 percent, diminished convergence in 40 percent, and no convergence in 18 percent. The pupillary-convergence reaction was frequently absent if convergence was absent. Convergence may be present if binocular

single vision does not exist. In convergent strabismus with diminished convergence a full operative correction should be avoided because it may be followed by crossed diplopia for near. Charles A. Bahn

Kirby, D. B. **The surgical treatment of strabismus.** *Arch. de la soc. para evitar la Cequera en Mexico*, 1945, v. 3, p. 123. (See *Amer. Jour. Ophth.*, 1946, v. 29, April, pp. 408-421.)

Jerome B. Thomas.

Lancaster, W. B. **What is orthoptics?** *Jour. Amer. Med. Assoc.*, 1946, v. 130, Feb. 16, p. 407.

Orthoptics is the art of teaching patients how to use their eyes properly. At birth the neuronc pathways involved in vision are imperfectly developed. Development may not progress in the normal or ideal way. Obstacles may turn the course of development into wrong channels. The duty of the orthoptic technician is to lead the patient to the acquisition of normal and useful habits and reflexes, and to teach him to coördinate and to control the reflex responses to his environment. The technician does not strive to strengthen allegedly weak muscles.

A major amblyoscope, stereoscope, prisms, and small accessories are indispensable. Glasses may help but are not indispensable. A surgical operation often saves much time and sometimes makes orthoptic training successful when it would be hopeless without surgery. R. Grunfeld.

O'Brien, F. H., and Bender, M. B. **Localizing value of vertical nystagmus.** *Arch. Neurol. and Psych.*, 1945, Nov.-Dec.

A case report of thrombosis of the anterior spinal artery of the medulla is presented. The symptoms were loss

of function of the pyramidal tract on the opposite side and vertical nystagmus. It was decided that the nystagmus had no localizing value other than to place the lesion in the brain stem.

Morris Kaplan.

Scobee, R. G., and Green, E. L. A center for ocular divergence; does it exist? *Amer. Jour. Ophth.*, 1946, v. 29, April, pp. 422-433. (1 figure, 1 table, references.)

Zeligs, M. A., and Joseph, G. F. Unilateral internal ophthalmoplegia: sole clinical sign in patient with syphilitic meningitis. *Arch. Neurol. and Psych.*, 1945, Nov.-Dec.

A very interesting case report is presented wherein a young man who complained of blurring of vision of the left eye is described. Thorough examination was negative except for a large, fixed pupil in the left eye, and a positive Wassermann reaction in blood and spinal fluid. Two courses of penicillin resulted in cure of the patient's lues and of his ocular disturbance.

Morris Kaplan.

5

CONJUNCTIVA

Bangerter, A. Pterygium operation and covering of conjunctival defects. *Ophthalmologica*, 1943, v. 106, Nov.-Dec., pp. 316-320.

The author describes a method whereby recurrence of pterygium can be avoided and the larger defects of the conjunctiva which occur after removal of tumors or cysts can be covered. His drawings show a rhomboid excision followed by undermining and mobilization of a large part of the upper bulbar conjunctiva. The lips of the wound are sutured to the lower

margin of the conjunctival defect so placed that normal conjunctiva lines the corneal margin throughout.

Max Hirschfelder.

Botteri, A., and Sokolić, P. Trachoma treatment with albucid. *Klin. M. f. Augenh.*, 1942, v. 108, July-Aug., p. 469.

At the University Eye Hospital at Zagreb an unspecified number of trachoma patients were treated with albucid locally and orally. (See also *Schweizer med. Woch.*, 1941, v. 42, p. 1215.) The greatest effect was obtained with combined local and oral medication. A number of patients responded surprisingly well to this treatment, another group less favorably, and a third showed almost no improvement even after three weeks of treatment. In this last group, additional mechanical therapy was necessary. Such cases are not rare but represent a minority of the total.

F. Nelson.

Fischer, I. Albucid treatment of trachoma. *Klin. M. f. Augenh.*, 1942, v. 108, July-Aug., p. 445.

At the University Eye Hospital at Jena, 23 patients with trachoma were treated without albucid in 1940 until March, 1941, and 17 were treated with albucid from March, 1941, until January, 1942. The author concludes that albucid alone, even in strong doses given locally and orally, cannot cure trachoma though it rapidly allays local irritation. If local mechanical and chemical (copper, alum) treatment is combined with oral albucid medication recovery occurs in half the usual time.

F. Nelson.

Friedman, B., and Gernand, H. Sjorgren's syndrome treated with stilbesterol. *California and Western Medicine*, 1946, v. 64, Jan., p. 31.

A woman, 24 years of age, com-

plained of burning pain in both eyes. The lids were hot and dry. There was no tearing, no photophobia, and no secretion. The complaints were intensified before menstruation. The left thumb was swollen and painful during the previous winter. Local therapy and vitamins gave no relief.

The consulting gynecologist found a dry vagina with pale and thin mucous membranes. The body of the uterus was studded with numerous small fibromas. Eventually a subtotal hysterectomy was performed. Both ovaries were found to be cystic and scarred to an extreme degree. Three mg. stilbesterol with 100 mg. vitamin C per day was prescribed and the patient now feels comfortable and all eye symptoms have disappeared. If she omits the stilbesterol or takes less the ocular discomfort returns. R. Grunfeld.

Gjessing, H. G. A. **Primary cancer of the conjunctiva.** *Acta Ophth.*, 1942, v. 20, pt. 1, pp. 14-23.

The literature is reviewed and a case of carcinoma of the limbus in a 63-year-old man is reported. The mother of the patient died of carcinoma of the stomach, and the patient previously had had a rodent ulcer of the lip. He attributed the bulbar carcinoma to a blow on the eye with a piece of wood; the lump appeared three months after the injury and was excised eight months later. It recurred, and was excised again six years later, this time followed by radium irradiation. It is emphasized that surgery should always be followed by irradiation. (Photograph.)

Ray K. Daily.

Glowatzky, F. **Experiments with sulfonamide therapy in trachoma.** *Klin. M. f. Augenh.*, 1942, v. 108, July-Aug., p. 449.

In the German University Eye Hos-

pital at Prague the effect of sulfa drugs was tested in 145 trachoma patients, 17 of whom were treated in the hospital itself. One hundred twenty-eight were German-Bessarabian inmates of a relocation camp. Eubasin (sulfapyridine) and albucid (p-amino-benzo-sulfoacetamide) were used. They were given orally in large doses for ten days followed by a rest period of six days. One hundred and one cases required two such courses, 39 needed three courses, and in 11 a fourth became necessary. After nine weeks 119 patients were free from symptoms. Glowatzky had the impression that the effect of eubasin manifests itself earlier than that of albucid but in the long run no definite difference between the two substances was noted. Additional local treatment with sulfa drugs seems to hasten the healing process. In seven cases of follicular conjunctivitis treatment with sulfonamides proved to be ineffective. (5 tables, bibliography.) F. Nelson.

Gogler and Mielke. **Treatment of trachoma with sulfonamides (albucid, eleudron, eubasin, and cibazol).** *Klin. M. f. Augenh.*, 1942, v. 108, July-Aug., p. 402.

Experiments with sulfa drugs were carried out in two hospitals in different localities; namely, Greifswald on the Baltic and Linz on the Danube. At the Linz Hospital 535 patients between one and 80 years of age were treated. The average time of treatment was 47 days; 70.47 percent were cured after three to seven weeks, 19.25 percent after 13 weeks, 9.16 percent after 17 weeks, 0.74 percent after 22 weeks, 0.37 percent required 22 to 26 weeks of treatment. First all patients received albucid, later eleudron was used. The effect of both drugs was about the same. Almost invariably the acute inflammatory symp-

toms improved as soon as treatment with sulfonamides was given but soon the condition became stationary. Local treatment consisted of instillation of 10-percent targesin twice daily and mechanical treatment of follicles with Knapp's roller forceps. The time of observation of not more than a year was insufficient to permit of definite conclusions.

At the Griefswald Hospital 33 of 60 trachoma patients were selected for treatment with sulfonamides. Thirteen patients were given albucid, 11 eubasin and nine cibazol. Rapid improvement of the irritation was observed. However, the follicles disappeared in only two cases in which the diagnosis trachoma was not absolutely certain. Though the sulfonamides undoubtedly represent an enrichment of our therapeutic armamentarium they do not fundamentally change the aspect of the disease. They should be applied as adjuvants in patients with acute irritation and secretion as well as in those with fresh corneal complications. Where only follicles are present and little irritation immediate mechanical treatment is indicated. Ambulant treatment with sulfonamides is not advisable because the dosage must be supervised closely. (1 plate with 9 color photographs, 2 photographs, 1 table.)

F. Nelson.

Kornerup, Tore. Histamin blood content in a case of allergic conjunctivitis. *Acta Ophth.*, 1942, v. 20, pt. 1, pp. 56-62.

The author reports a case of allergic conjunctivitis, with an increased histamine blood content, relieved by treatment with histaminase. The interesting feature of this case is the parallelism between the rise in the blood histamine and the clinical recurrence of symptoms. Ray K. Daily.

Lorenz, R. Reëxamination of trachoma patients treated previously with albucid. *Klin. M. f. Augenh.*, 1942, v. 108, July-Aug., p. 414.

Of 43 trachoma patients reported in a previous article (*Klin. M. f. Augenh.*, v. 106, pp. 302-306), who had been treated with albucid, 23 were re-examined four to 21 months after they had been released. Recurrences were not observed in any. One patient had been treated with uliron instead of albucid. Follicular, catarrhal and vernal conjunctivitis and paratrachoma were not influenced by sulfonamides.

F. Nelson.

Lugossy, G. The chemotherapy of trachoma. *Klin. M. f. Augenh.*, 1942, v. 108, July-Aug., p. 474.

At the University Eye Department at Szeged, 31 trachoma patients, of whom 21 were hospitalized, were treated with albucid. The patients were divided into 4 groups and given albucid in different doses by mouth and locally. The effect of albucid is favorable no matter what method of medication is used. The effect is most pronounced in patients with acute inflammation in any stage of trachoma. Spectacular success is achieved in trachoma complicated by pannus. Albucid in large doses also has diagnostic merit: rapid healing of acute ophthalmic inflammation rules out trachoma. Trachoma does not heal so rapidly. Since the introduction of albucid the average stay in the hospital was reduced to three weeks, and in many cases was unnecessary. (References.)

F. Nelson.

Lauber, H. Sulfonamide treatment of trachoma. *Klin. M. f. Augenh.*, 1942, v. 108, July-Aug., p. 460.

At the Krakau Eye Hospital several sulfonamides were used in combating trachoma. Essentially the effect of

these preparations was identical. The combination of medico-mechanical procedures with internal sulfonamide medication shortens the healing process considerably. (4 color photographs.) F. Nelson.

Meesmann, A., and Bruhn, A. Trachoma treatment with sulfonamides. *Klin. M. f. Augenh.*, 1942, v. 108, July-Aug., p. 464.

Up to 1940 only a negligible number of cases of trachoma had been seen at the University Eye Hospital at Kiel. With the influx of foreign labor, mostly Poles, this number increased noticeably. In June, 1941, sulfanamide therapy was introduced. Seventeen patients, among them six with fresh lesions were treated with albucid; tetracid, and cibazol. In no case were the sulfonamides alone effective. Other medicinal and mechanical methods were always necessary to complete recovery. F. Nelson.

Meisner, W. Treatment of trachoma with sulfonamides. *Klin. M. f. Augenh.*, 1942, v. 108, July-Aug., p. 458.

At the University Eye Hospital at Munich a number of trachoma patients, mostly repatriated German-Bessarabians were treated with eubasin. Meisner was under the impression that the drug influenced the superimposed conjunctivitis and pannus favorably. Granules showed only temporary, if any, improvement. Not a single case of trachoma, even a fresh one, could be cured with the drug. The hospital staff felt compelled to resort to the old methods, not only in order to shorten the time of treatment but also to accomplish an eventual cure.

F. Nelson.

Miao, T. Y. Trachoma among primary school children. *West China Med. Bull.*, 1945, v. 2, June 15, p. 35.

In the fall of 1944 a survey was conducted in 11 primary schools in and around Chengtu to discover the prevalence of eye diseases among the children. A total of 4,993 children were examined of whom 2,802 were male and 2,191 female. Nearly one third of the children, 1,600, had some kind of ocular ailment; 1,002, or 20.1 percent, had trachoma. (5 tables.)

China Medical Journal.

Miranda, G. Treatment of trachoma with sulfonamides. *Klin. M. f. Augenh.*, 1942, v. 108, July-Aug., p. 482.

Forty-seven trachoma patients between the ages of 12 and 45 years received ambulant treatment with 0.03 gm. sulfonamide per kg. body weight daily over a period of 15 days followed by a rest period of eight days. This regimen was continued over a second, third, and sometimes fourth and fifth cycle. Additional local treatment consisted of atropine only when the cornea was involved. In 12 cases a 5-percent ointment of the drug was administered. All eyes with corneal complications improved. Of those with conjunctival trachoma only 29 improved and 18 remained unchanged. Complete cure with scar formation was observed only once. Improvements were usually observed after eight days. (Bibliography.)

F. Nelson.

Osterberg, G. Lucosil for local treatment in ophthalmology. *Acta Ophth.*, 1942, v. 20, pts. 3-4, pp. 321-336.

Lucosil is a water-soluble sulfonamide, neutral in reaction, and marketed in a 40- to 4-percent aqueous solution. Osterberg investigated its usefulness in local application in ophthalmology, experimentally and clinically. The investigation demonstrated that except in allergic patients, it is harmless and nonirritating to the conjunctiva, that

it is therapeutically effective in experimental keratitis, and that it is clinically effective in the treatment of various forms of keratitis, chronic blepharoconjunctivitis, and acute dacryocystitis. (6 illustrations.) Ray K. Daily.

Purtscher, Ernst. Trachoma therapy with albucid. *Klin. M. f. Augenh.*, 1942, v. 108, July-Aug., p. 442.

From October, 1940, until December, 1941, 29 of 41 patients with old trachoma received hospital treatment with albucid at the University Eye Hospital at Graz. Five patients were treated locally with albucid ointment only and without noticeable benefit. The other patients received albucid orally (3 tablets 3 times daily for 7 consecutive days); in nine patients this dosage was sufficient, in ten it was repeated once, in two, thrice and in three, four times. Usually after this regimen one tablet daily was given. As additional local treatment boric acid or zinc drops and 10-percent albucid ointment were used. The catarrhal condition disappeared rapidly. The papillary hypertrophy and pannus improved, follicles often diminished, and corneal ulcers healed. Cicatrizing of the trachomatous conjunctiva, which Purtscher regards as the safest clinical criterion of the healing process, was never achieved with albucid therapy. Albucid, like other sulfonamides, is a valuable help in combating fresh trachoma, but it does not seem noticeably to influence the deep proliferating inflammation of the conjunctiva.

F. Nelson.

Rohrschneider, W. The effect of albucid in trachoma. *Klin. M. f. Augenh.*, 1942, v. 108, July-Aug., p. 430.

In 53 cases of trachoma in different stages the effect of albucid on the con-

junctival and corneal lesions was studied systematically. About one third of the lesions were influenced so favorably that one could speak of a clinical cure. The treatment consisted of huge doses of albucid for three days alternating with periods of rest. Two or three courses of this kind with a one-week rest period between were necessary. Rohrschneider concludes that albucid proved valuable in the treatment of trachoma, though additional mechanical and chemical treatment is sometimes needed. Because of recurrences, the possibility of absolute cure can be estimated only after years of observation. Albucid was tolerated well by all patients. F. Nelson.

Schindler, R. Experiments with albucid as a therapeutic agent against conjunctival infections, especially trachoma. *Klin. M. f. Augenh.*, 1942, v. 108, July-Aug., p. 420.

At the First University Eye Hospital in Vienna, 12 patients suffering from trachoma were subjected to ambulant treatment with albucid (p-amino-benzosulfonacetamid). Seven patients with newly acquired trachoma were given albucid in comparatively large doses over a period of three days, followed by a rest period of three days, after which the same treatment was repeated. Since albucid is eliminated from the body in four days the patient remains under the influence of the drug. In advanced trachoma the treatment consisted of continuous doses (0.03 gm. per kg. body weight daily) over a period of three to four weeks followed by a rest period of at least four weeks. Fresh cases manifested no spectacular objective improvement during or after the first course of treatment. However, all of the patients were made more comfortable. During

the second course the improvement was rather impressive and even more so during the third. In some cases a fourth and fifth course became necessary. Local treatment was not administered in any case. Photophobia and discharge disappear rapidly in early trachoma. Granules and papillary hypertrophy disappear more slowly, usually in one or two months after the conclusion of the albucid medication. Incipient pannus undergoes involution early. Five patients with old trachoma who had all been treated with copper sulfate, and two of whom had corneal ulcers, improved after the second week of treatment with albucid. Pannus disappeared gradually. Complicating infections that were present in all these patients were eliminated within four to eight days. The granules were reduced in size and number, and the conjunctiva became pale after four weeks of albucid without local therapy. The author prefers not to speak of an absolute cure of trachoma by means of albucid, but calls the condition "inactive trachoma." All patients with nontrachomatous conjunctival inflammation were cured without local treatment in two to four days.

F. Nelson.

Scheyhing, H. The treatment of trachoma with albucid. *Klin. M. f. Augenh.*, 1942, v. 108, July-Aug., p. 436.

The resettlement of large numbers of racial Germans (*Volksdeutsche*) from regions outside the Reich, especially from eastern countries, made the establishment of clearing camps and special trachoma clinics necessary. In the clearing station under the direction of the Würzburg University Eye Hospital, 82 patients with trachoma received treatment and all but six of them have recovered. A little more than one third of the fresh cases and two thirds

of the older ones were clinically cured with albucid therapy. In most cases treatment for two to six months was sufficient. Since the percentage of real cures was relatively small, Scheyhing's conclusion is that albucid therapy does not fulfill expectations. F. Nelson.

Seefelder, R. Sulfonamide-therapy of trachoma at the University Eye Hospital at Innsbruck. *Klin. M. f. Augenh.*, 1942, v. 108, July-Aug., p. 466.

Four cases of trachoma were treated with sulfonamides. Corneal trachoma responded most favorably to the drugs. Subconjunctival application of pron-tosil did not hasten the healing process. Of two additional patients seen during the printing of this article one did not continue treatment; the other showed marked improvement of his extensive pannus and improvement of vision but additional local mechanical treatment was needed.

F. Nelson.

Weiszlovits, E. Treatment of ophthalmia neonatorum and serpiginous ulcer with sulfonamides. *Ophthalmologica*, 1944, v. 108, Sept., pp. 121-128.

Ophthalmia neonatorum was successfully treated with a 15-percent albucid solution. In adults the internal use is recommended as additional medication. Local and internal treatment of serpiginous ulcers by sulfonamides was effective.

Max Hirschfelder.

6

CORNEA AND SCLERA

Lo, L. Y., and Tang, P. C. Dendritic ulcer of the cornea. *West China Med. Bull.*, 1945, v. 2, June 15, p. 67.

This paper embodies the report of seven cases of dendritic ulcer of the cornea. The etiology and treatment of the disease are discussed. It is believed

that a virus is the causative agent. Malaria is also an important contributing factor. At least five of the seven patients had malarial fever shortly before the onset of the ocular affection. (19 diagrams, references.)

China Medical Journal.

Sun, K. S. Nodular scleritis. *West China Med. Bull.*, 1945, v. 2, June 15, p. 56.

Five cases of nodular scleritis are reported. The patients were admitted to the Chengtu Eye, Ear, Nose, and Throat Hospital, where careful studies were made and thorough treatment given. Four of them were male and one female, their ages ranged between 20 and 30 years. In two of them the lesion was apparently caused by syphilis and in two by tuberculosis; in the other by a focal infection. All the patients were improved upon discharge. Two patients had complications, one had early iritis, the other keratitis, and both recovered. (References.)

China Medical Journal.

Weiszlovitis, E. Treatment of ophthalmia neonatorum and serpiginous ulcer with sulfonamides. *Ophthalmologica*, 1944, v. 108, Sept., pp. 121-128. (See Section 5, Conjunctiva.)

Westerlund, E. Keratitis nummularis (Dimmer). *Acta Ophth.*, 1942, v. 20, pts. 3-4, pp. 367-378.

A review of the literature, and a report of the first eight cases of epidemic keratoconjunctivitis in Scandinavia are presented. The first patient, seen in 1940, developed the disease after a brief sojourn in Germany. The other seven cases occurred in the summer and fall of 1942.

Ray K. Daily.

Woods, A. C. and Chesney, A. M. The eye and immunity in syphilis.

Amer. Jour. Ophth., 1946, v. 29, April, pp. 389-400. (7 figures, references.)

7

UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Birkhaeuser, R. Eye diseases through infectious foci in the teeth. *Ophthalmologica*, 1944, v. 107, Jan.-Feb., pp. 3-16.

Ten cases of inflammation of various parts of the eye (cornea, uvea, optic nerve) are described individually. In each patient X-ray examination revealed defective teeth, and the eye recovered after the dental focus was treated.

Max Hirschfelder.

Chan, Eugene. Polycoria. *Nat. Med. Jour. China*, 1945, v. 31, April, p. 137.

The two oldest cases of polycoria in China are those noted by Szu-ma Chien (born 145 B.C.) who stated that Emperor Shun (2255-2205 B.C.) as well as King Hsiang Yu (232-202 B.C.) had double pupils. From other ancient Chinese sources, the author has brought to light eight additional cases. He calls attention to the classification of polycoria: (1) Polycoria vera; (2) Iridodehiscence; (3) Iridodiasis. He examined three patients with polycoria. A girl, three years of age, had true polycoria in her right eye. The other two cases of abnormal pupil were not typical. The abnormality was evidently caused by persistent pupillary membrane, and in one of them there was localized hypoplasia of the iris stroma as well.

China Medical Journal.

Godtfredsen, Erik. Reëxamination of central ruptures of the choroid. *Acta Ophth.*, 1942, v. 20, pts. 3-4, pp. 335-350.

The close relation of the pathogenesis of rupture of the choroid, Ber-

lin's edema; subretinal hemorrhage, and macular hole is pointed out. A follow-up study of 12 cases of rupture of the choroid, which are briefly reported, demonstrates the seriousness of the prognosis in such accidents. The final central visual acuity was below 6/60 in seven patients. In five other patients, after transitory visual impairment the final vision was 6/6 in four, and 6/12 in the other one; three of the five eyes had ruptures through the fovea. The visual improvement usually takes place within the first few weeks. Visual impairment which persists longer than two months is apt to remain permanent. Particularly interesting is a patient whose right eye sustained bulbar contusions twice within six months. The first injury produced five choroidal ruptures, one of them through the fovea, and the second resulted in a hemorrhage in the fovea. The final visual acuity, observed for a period of two years, was 6/6.

Ray K. Daily.

Hallett, J. W. Report of a case of iridocyclitis associated with chickenpox. *Amer. Jour. Ophth.*, 1946, v. 29, April, pp. 459-460. (Reference.)

Holst, J. C. Congenital myosis. *Acta Ophth.*, 1942, v. 20, pts. 3-4, pp. 494-505.

A case of congenital familial myosis is reported. The symptoms were pain in and behind the eyes and at the back of the head, decreased vision, and hemeralopia. The patient has been using a weak solution of scopolamine with relief of symptoms for 45 years; the symptoms recurred whenever she attempted to do without the scopolamine. A brother and sister had similar eyes, and after their death these were examined microscopically. The sections show a faulty or incomplete develop-

ment of the dilator of the pupil. Wherever a trace of the muscle was found it had no peripheral attachment, so that it could not function.

A preliminary microscopic study of another case is reported. A child, 2½ years of age, with congenital cataracts and myosis, had iridectomies performed on both eyes. The right lens was injured during surgery; the eye developed an inflammation and was enucleated. The microscopic sections showed no trace of the dilator of the pupil, and a part of the ciliary muscle was found in the periphery of the iris stroma.

Of 13 cases found in the literature, only the eye described by Redslob had been examined histologically, and it had defective iris musculature. The familial occurrence is shown by Holth and Berner, who report three affected children in a family of 11, and by Sautter, who found five in one family.

Ray K. Daily.

Kiss, F. The blood circulation of the eye. *Ophthalmologica*, 1943, v. 106, Nov.-Dec., pp. 226-250.

By injecting eyes of man, rabbits, dogs, and cats with dyes through the ophthalmic artery and through the facial vein the author studied the branching, topography, and interrelation of the blood vessels in various parts in the eye. The vascular system of the ciliary body consists of two parts: (1) the broad vessels of the ciliary process, which are similar to the broad veins of the iris, and (2) the narrow vessels of a so-called ciliary plexus in the region of the ciliary muscle. The veins of the ciliary process end in the system of the choroid, whereas those of the ciliary plexus penetrate the sclera and end in the episcleral system. The author believes

that the blood vessels of the iris do not serve to resorb the aqueous, but that such resorption takes place in the ciliary plexus. The plexus may be considered as a second capillary region of the broad iris veins. The vessels of the ciliary processes, on the other hand, take part in the production of the aqueous. On the basis of experiments with injection of dyes into the anterior chamber, the author expresses the opinion that the canal of Schlemm does not play an important part in the resorption of the aqueous humor. The circulation of the blood and of the aqueous normally in a labile balance which is primarily regulated by the arterial influx. The article is very detailed and there is much speculation about the circulation and its relation to glaucoma, in which this labile balance is disturbed. Max Hirschfelder.

Rasmussen, Knead. Acquired ectropion of the uvea. *Acta Ophth.*, 1942, v. 20, pts. 3-4, pp. 310-320.

A detailed histopathologic study of 12 enucleated eyes which had ectropion of the uvea of varying degree, from small to total, is reported. These eyes had peripheral anterior synechiae corresponding in extent to the ectropion; a membrane on the anterior surface of the iris, varying from a very fine veil to a very thick membrane; folds in the anterior layer of the iris; more or less pronounced atrophy of the iris; ectropion of the sphincter of the pupil in a lesser degree than that of the pigment epithelium; and proliferation of the pigment epithelium. A single pathologic process cannot explain the development of ectropion of the uvea. It seems probable that several factors cooperate in its production. Clinically, its appearance suggests progression of the primary disease. Tumors, glaucoma,

trauma, or severe hemorrhages may give rise to a slow chronic uveitis, with the formation of anterior synechia, exudate which shrinks subsequently, atrophy of the iris, and degeneration and proliferation of the pigment epithelium. These processes lead to ectropion of the uvea. Ray K. Daily.

Redslob, M. E. A strange case of internal ophthalmoplegia. *Ann. d'Ocul.*, 1945, v. 178, June, pp. 121-123.

A smoking mixture used to relieve asthmatic attacks was mixed by the patient with his pipe tobacco. It contained belladonna and enough was absorbed in the saliva to produce mydriasis and cycloplegia. Charles A. Bahn.

Waardenburg, P. J. Chorioideremia as an inherited anomaly. *Acta Ophth.*, 1942, v. 20, pts. 3-4, pp. 235-274.

The following conclusions are based on an exhaustive review of the literature.

Chorioideremia occurs in two clinical forms: an early congenital infantile form, and a late juvenile form.

The early form is typical. Except in the foveal region, the choroid is entirely absent, and the fundus is white. In less typical cases choroidal vestiges and pigment spots may be seen in the periphery of the fundus. The condition remains stationary for a long time; finally, however, central vision is lost. The anomaly is probably due to a disturbance in the development of the primitive choriocapillaris and the long posterior ciliary arteries, and a simultaneous interference with the pigment development in the outer layer of the secondary optic vesicle. Night blindness and constriction of the visual fields are present from early infancy, due to the involvement of the neuroepithelial layer. This form of the disease is fre-

quently associated with a moderate degree of myopia. The second form is characterized by a slowly progressive course, with deterioration of vision, due to the confluence of dystrophic areas. This form resembles a typical gyrate atrophy of the choroid and has no connection with myopia.

Genetically both forms are probably sex-linked. The infantile form appears to be recessive, and the late juvenile form intermediary.

There is not sufficient evidence in the literature for the assumption that both types are transmitted through an X-chromosome.

Chorioideremia is not clinically nor biologically the end stage of gyrate atrophy. Occasionally the end stages of gyrate atrophy, particularly that occurring in high myopia with peripapillary atrophy, may resemble chorioideremia.

The data in the literature are too inadequate to permit of definite conclusions. It is desirable that all relatives of patients be examined as early as possible, and repeatedly, and that the eyes of all still-born males in the siblings be examined microscopically. In reporting cases in which the disease is apparently transmitted from father to son, the history should be clear on the question of consanguinity in the parents.

Ray K. Daily.

8

GLAUCOMA AND OCULAR TENSION

Kjerrumgaard, Erling. On tonometry. *Acta Ophth.*, 1942, v. 20, pts. 3-4, pp. 357-366.

This investigation was concerned with the gaging of tonometers, and with the effect of manipulative errors on the accuracy of tonometric measurements. The author concludes that the two models of the Schiøtz tonometer

are equally reliable. It is essential that the instrument should be placed accurately, centrally on the cornea, and in line with the optic axis. An inclination of 15 degrees from the center of the cornea does not invalidate the findings, but an inclination of 30 degrees makes the readings worthless. It is important that the foot be in close contact with the cornea. The patient's coöperation in looking quietly and not squeezing the lids around the instrument is essential. Squeezing the lids disturbs the relation between the instrument and the cornea and makes the reading unreliable. (Graphs.) Ray K. Daily.

Owens, E. U., and Woods, A. C. Further studies on the use of furmethide in the treatment of glaucoma. *Amer. Jour. Ophth.*, 1946, v. 29, April, pp. 447-450. (3 tables, references.)

Radnot, Magda. Male gonads and intraocular pressure. *Ophthalmologica*, 1944, v. 107, May-June, pp. 282-289.

Experiments with rabbits showed that castration caused hypotony of short duration. Unilateral castration, unilateral ligation of the ductus deferens, and X ray treatment of one testicle caused hypotony of the contralateral eye. Diminished or lost function of the testicles seems to alter the response of the ocular tension to extract of the anterior pituitary lobe. This extract normally lowers the pressure but stimulates a rise of the ocular tension in castrated animals.

Max Hirschfelder.

Radnot, Magda. The suprarenal gland and the intraocular pressure. *Ophthalmologica*, 1944, v. 108, Sept., pp. 137-139.

Disturbances in the hormone-producing organs may affect the intraocular pressure. Extirpation of the suprarenal

gland brought about a lowering of the intraocular pressure on the side of the extirpated gland. This differs from the behavior after extirpation of the sexual glands, which is followed by a contralateral lowering of the intraocular pressure.
Max Hirschfelder.

Weekers, R. Myopia and traumatic hypotony. *Ann. d'Ocul.*, 1945, v. 178, June, pp. 236-241.

A boy, aged 11 years, who was injured twice in the same eye, first by a stone and six weeks later with a fist, developed a myopia of 3.5D. to 5D. and hypotony after each injury. Following the use of atropin, both subsided in about six weeks, with normal vision. The author assumes that the myopia and the hypotony were due to a relaxation of the zonule of Zinn following a hyperemia and edema of the ciliary body.
Charles A. Bahn.

9

CRYSTALLINE LENS

Bischler, V. Binocular vision in the aphakic patient. *Ann. d'Ocul.*, 1945, v. 178, July, pp. 273-279.

In the opinion of Deverger and Velter cataract extraction in the first eye is usually a necessity; that of the second eye, a luxury. In 50 patients successfully operated upon because of congenital or senile cataracts in both eyes, 49 had binocular vision and 47 stereoscopic vision. The ages ranged from 28 to 81 years, the time between operations on both eyes, two to eight years, and the corrected vision after operation on both eyes, from 0.3 to 1.0. Patients with cataracts due to trauma, disease, and with marked oculomotor anomalies were eliminated from the series. The author concludes that cataract operation of the second eye, generally speak-

ing, is not a luxury but also a necessity, if binocular vision is probable.

Charles A. Bahn.

Blake, E. M. Congenital membranous cataract. *Amer. Jour. Ophth.*, 1946, v. 29, April, p. 464.

Cherif, M. D. Anesthesia in cataract operations. *Arch. de la Asoc. para evitar la Ceguera en Mexico*, 1945, v. 3, p. 167.

After a brief historical review of the use of general and local anesthesia in ocular surgery, the author states his personal conclusions:

He prefers cocaine in 4-percent solution for local operations and for cataract extraction, and disapproves of the additional use of retrobulbar injection of novocaine, unless especially indicated by complicating factors, such as pain and increased tension. He objects to the use of retrobulbar injections because of the possibility of hemorrhage from lesions of the retrobulbar vessels, injury to the optic nerve, and dislocation of the globe to such a degree as to require fixation of the superior rectus, with consequent deformity of the cornea and loss of vitreous. The author employs palpebral akinesia only under special conditions, but, when indicated, he prefers the technique of O'Brien to that of Van Lint, because it avoids infiltration of the lids and consequent edema. He condemns the systematic practice of external canthotomy, and fixation of the superior rectus.
Jerome B. Thomas.

Cordes, F. C., and Cordero-Moreno, R. Atopic cataracts. *Amer. Jour. Ophth.*, 1946, v. 29, April, pp. 402-407. (References.)

Godtfredsen, Erick. Electric cataract and electro-cardiographic changes after

electric shock. *Acta Ophth.*, 1940, v. 2, pt. 1, pp. 69-79.

Visual disturbances in the right eye and electro-cardiographic changes developed in a farmer aged 23 years, who was struck above the right eye by a wire which carried a 220-volt current. The lids of the right eye were burned, and the anterior surface of the lens was dotted with numerous small, slightly elevated vesicles. Eight days later the lens opacities assumed the form of a rosette which involved the portion of the lens which was in contact with the pupillary border, and left the periphery and center transparent. The vision was reduced to 6/12. The opacities disappeared within four weeks, with recovery of normal vision. At this time a subcapsular, more centrally located, irregularly reticulated opacity was found; it became progressively denser, and at the end of three months vision was reduced to 6/12. These findings are similar to those reported by Croci. The lens changes are attributed to an electrothermal epithelial injury to the lens capsule, the opacities being the result of a disturbance in nutrition. (Illustration.)

Ray K. Daily.

Henkes, H. E. The distribution of vitamin C in the lens of the eye. *Ophthalmologica*, 1944, v. 108, July-Aug., pp. 11-43.

By means of microtitration according to Glick and Biskind as well as by histochemical methods according to Giroud and Leblond the lenses of various animals (cattle, rabbits, guinea pigs, rats, mice, and cats) were examined for the vitamin-C content at various levels. The author cut a cylinder from the lens, with a trephine, cut the cylinder in 10 sections on a microtome and measured the vitamin-C content of the sections.

Lens capsule and lens epithelium have little vitamin C. The peripheral cortex of young lenses has the highest ascorbinic-acid content, which decreases slowly towards the inner cortical parts and decreases still more, and more abruptly, in the lens nucleus. Older lenses have less vitamin C, the peripheral lens cortex (as compared with the inner cortical parts) is relatively poorer in vitamin C and the values in the nucleus may decrease to zero. The distribution of vitamin C at different lens levels varied according to the various groups of animals, but all of them showed higher values in the cortex than in the nucleus. The author investigated the influence of vitamin-C-free diet on the vitamin-C content of the lens in guinea pigs and found that the peripheral parts of the cortex are the first to decrease in vitamin C, that the values in cortex and nucleus reach zero after 10 to 15 days, and that the peripheral cortex shows a rapid recovery of vitamin-C content after 24 hours of a diet containing vitamin C.

Max Hirschfelder.

Radnot, Magda. A rare case of luxation of the lens. *Ophthalmologica*, 1943, v. 106, Nov.-Dec., pp. 312-315.

In an eye which had been injured three months before enucleation the lens was found adherent to the detached and folded retina just in front of the papilla. Presumably the shrinkage of newly formed connective tissue after hemorrhage into the vitreous pulled the lens towards the retina.

Max Hirschfelder.

Shah, M. A. Glass-blower's cataract. *Indian Med. Gazette*, 1945, v. 80, p. 400.

After a short history of glass-blowers' cataract, the author presents his experimental work. He exposed six rab-

bits to varying numbers of 5-minute periods of heat which was free from infra-red radiations. All the animals developed opacities of the peripheral cortex. Since glass-blowers' cataract always occurs axially in the posterior cortex it was concluded that some factors other than the heat radiations were most probably responsible.

Morris Kaplan.

Sobhy Bey, M. Why intracapsular extraction in senile cataract? *Ann. d'Ocul.*, 1945, v. 178, July, pp. 279-286.

Senile cataract should usually be operated upon as soon as it is sure that defective vision will seriously handicap the patient. The advantages and disadvantages of intracapsular, and extracapsular extractions are discussed. Retinal detachment is more frequent after intracapsular, and secondary glaucoma more frequent after extracapsular operations. The technique used by the author is that generally employed in this country. It includes orbital injection and topical anesthesia, akinesia, a superior-rectus thread, complete iridectomy in extracapsular extraction and basal iridectomy in intracapsular, and conjunctival or corneoscleral sutures. Either capsule forceps or Barraquer suction are used in intracapsular extractions. In monocular patients, the extracapsular technique is preferred. In binocular patients with one eye successfully operated upon, the intracapsular method is generally used.

Charles A. Bahn.

Sun, K. S. Suturing of the wound in cataract extraction. *West China Med. Bull.*, 1945, v. 2, June 15, p. 46.

The advantages of applying sutures in cataract surgery are discussed in detail. The author believes that the application of well-chosen and carefully

practiced technique of suturing helps those of limited skill to perform operations satisfactorily. For the last four years the author had used the Stallard suture, with certain modifications, in all the cataract operations performed by himself and others under his instruction. A new method of managing the emptied anterior chamber, before sectioning, is described. (6 diagrams, references.) *China Medical Journal.*

Zeeman, W. P. C. Congenital dislocation of the lens. *Acta Ophth.*, v. 20, pt. 1, pp. 1-13.

Zeeman reviews the histories of 30 patients. If congenital ectopia lentis is left alone the prognosis is poor, because cataract, retinal detachment, glaucoma, myopic changes, and amblyopia are frequent complications. Of 45 untreated eyes, five developed retinal detachment, eight cataract, and five glaucoma. Three eyes had poor visual acuity because of high myopia. Ten eyes were amblyopic. Only 14 of the 45 eyes had visual acuity adequate for work; in two of these it deteriorated subsequently, owing to myopic degeneration in one, and retinal detachment in the other. Zeeman believes that a two-needle discission is the operation of choice. The dislocated lens is difficult to manipulate with one needle. Even with two needles the operation is difficult and must often be repeated several times. Three cases are reported in detail. One patient was treated by discission with two needles, and the result was good visual acuity in both eyes. In the second patient discission was followed by extraction in the right eye, and a loop extraction in the left; the result was vision $\frac{3}{4}$ in the right eye, and atrophy of the globe in the left eye. The third patient developed secondary glaucoma in the right eye.

at the age of 50 years. A loop extraction of the lens, was followed by a postoperative iridocyclitis, with sympathetic ophthalmia, in the left eye. The eyes slowly recovered, and one year after the operation vision was $1/4$ in the right eye and $1/10$ in the left. Four years later the right eye was blind from glaucoma, and the left lens was opaque.

Ray K. Daily.

10

RETINA AND VITREOUS

Bedell, A. J. *Clinical differentiation of emboli in the retinal arteries from endarteritis.* Arch. of Ophth., 1945, v. 34, Oct., pp. 311-317.

Detailed ophthalmoscopic studies and particularly studies of repeated fundus photographs indicate a difference in the fundus picture of embolus and of endarteritis. In embolus of the central retinal artery, the arteries become mere threads, and the veins are greatly reduced in size. In endarteritis, the arteries are rarely so small as in embolism. The arterial walls always have plaques. The retinal edema from embolism is limited to an oval area that includes the disc and macula. In endarteritis the edema usually involves the entire fundus. Six cases of embolism and endarteritis are reported in detail. (9 fundus photographs.)

John C. Long.

Biró, I. *The connection between pigment degeneration of the retina and disturbances of the ear.* Ophthalmologica, 1944, v. 107, March-April, pp. 149-157.

Pigment degeneration of the retina sometimes follows a dominant pattern of inheritance, and at others is recessive. When recessive, particularly in families with intermarriages, disturb-

ances of the hearing are often found. The nervous elements of the inner ear (Corti's organ) and fibers and ganglion cells of the acoustic nerve are affected. One must assume that there is a hereditary and phylogenetic connection between the lesions of the eye and the ear. It is not possible at this time to differentiate histologically the dominant type of pigment degeneration, which is only confined to the eye, and the recessive type, which shows disturbances of the ear, polydactyly, and other abnormalities. (Bibliography.)

Max Hirschfelder.

Canales, J. S. *Motility of intraocular cysticercus.* Arch. de la Asoc. para evitar la Seguera en Mexico, 1945, v. 3, p. 31.

This study, based on the observation of 11 cases of cysticercus in the vitreous and the subretinal tissues, is of considerable biologic interest, but of only limited interest to the ophthalmologist. The author with infinite patience has conducted examinations of these larvae, at frequent intervals, to determine the character and speed of their contractions. He finds that the speed of contraction diminishes from almost constant undulatory movements in cases of intraocular infestation of a few days' standing, to complete cessation after about two years. He describes seven varieties of movements. These are illustrated by a series of 10 photographs of a subretinal cysticercus located near the optic disc. Careful and extensive explanatory notes are added. In a cysticercus eight months old he conducted observations with the electric ophthalmoscope, and the biomicroscope before and after instillation of atropine, pontocaine, and cocaine. No definite conclusions were reported. However, it was noted that changes of motility of the

parasite began about two minutes after the instillation of the drugs, which suggests that the drugs were rapidly absorbed into the interior of the eye ball. (10 references.) Jerome B. Thomas.

Chan, Eugene. Glioma. West China Med. Bull., 1945, v. 2, June 15, p. 43.

One of the oldest records on glioma in China was noted in Lang Ying's Tsi Hsiu Lei Kao, written in the beginning of the 16th century. The writer adds another case report to the Chinese literature. The present case is unique in that the patient underwent operation earlier in the course of the disease and was followed up longer than occurred in any other cases known in this country. It was in a Shantung girl, seven years of age. (References.)

China Medical Journal.

Delbes, P. Veil's juxtachoroidal galvanocauterization in retinal detachment. Ann. d'Ocul., 1945, v. 178, March, pp. 110-121.

Simple galvanocautery with very fine needles was used successfully in five or six patients. The detachment and tear were drawn on a transparent sheet containing an outline of the fundus. This was used as a guide during the operation with ophthalmoscopic verification. Punctures should be only deep enough to appear as faint fundus dots with the ophthalmoscope. The detachment is first delimited peripherally with a number of punctures. A smaller circle of punctures is placed about the tear. If ophthalmoscopic examination is not possible, the circle must be somewhat larger. The last few punctures are made deep to permit escape of the subretinal fluid.

Charles A. Bahn.

Doesschate, J. Ten. The first case of Oguchi's disease (type 1) in Holland.

Ophthalmologica, 1944, v. 108, July-Aug., pp. 1-10.

A 17-year-old girl, the offspring of blood relatives, exhibited the symptoms and signs of Oguchi's disease. Dark adaptation was inhibited in the early stages and the retina was greyish-white in color during light adaptation. This color disappeared after the patient stayed in the dark for several hours and the fundus color returned to normal. The article discusses the literature on the subject, especially the work of Nakamura who sees in the disease an analogy to the migration of pigment in the retina of frogs and other amphibious animals. The author stresses the fact that the course of the disturbance of adaptation is not completely explained by this analogy, even though there are points which speak for the correctness of Nakamura's theory. (Bibliography.)

Max Hirschfelder.

Goldsmith, J. Periarteritis nodosa with involvement of the choroidal and retinal arteries. Amer. Jour. Ophth., 1946, v. 29, April, pp. 435-446. (13 figures, references.)

Koch, F. L. P. Retinal vascular micrometry and essential hypertension. Arch. of Ophth., 1945, v. 34, Oct., pp. 321-334.

The methods employed in the measurement of retinal blood vessels are reviewed in detail. The arteries in the vicinity of the nerve head in normal persons are found to range in caliber from 50 to 120 μ when measured with the heliometer. The anatomy and physiology of the arterial vessels of the retina are discussed.

The development of various theories of hypertensive vascular disease is given. The author quotes his measure-

ments, along with those of others, of the mean caliber of retinal arterioles in the four groups of hypertension. The classifications of Keith and Wagener and of Volhard are used. The review is so comprehensive that it cannot be easily abstracted. John C. Long.

Kraus, A. C. Provisual red and visual red. *Amer. Jour. of Physiol.*, 1946, v. 145, Feb., p. 561.

From the bovine retina provisual red and visual red were isolated. Visual red was prepared directly from provisual red and from the residue obtained in the preparation of the provisual red. Both substances are a red, viscous, amorphous lipid. They are soluble in acetone, ether, chloroform, and glacial acetic acid, are insoluble in water, and do not crystallize. The provisual red is soluble in alcohol; the visual red is fairly soluble in absolute alcohol, but almost insoluble in 85 percent aqueous ethyl alcohol.

Absorption spectra of the provisual red in absolute alcohol begin at 540 $\mu\mu$ and are maximal at 440 $\mu\mu$ and 330 $\mu\mu$. Visual red with antimony trichloride in chloroform gave a bluish-purple color with a maximal spectral absorption at 480 $\mu\mu$. Preliminary analytic data for the determination of the molecular structure of these substances are reported. R. Grunfeld.

Kurz, O. The problem of retinal cysts. *Ophthalmologica*, 1944, v. 107, May-June, pp. 233-255.

Four cases of retinal cyst are discussed. Two of them were observed in connection with retinal detachment. The retina tore near the ora serrata, and large cysts were formed next to the area of tearing. In both cases there was also a cyst in the macular area which could not be seen with ordinary oph-

thalmoscopy, even when a red-free filter was used. Only slitlamp observation with the use of a special contact glass brought out the true character of the macular lesion. In one of these eyes satisfactory surgery was not followed by good vision. The retina of young people with retinal detachment which is characterized by ruptures at the ora serrata and which has a tendency to cyst formation should be examined with the slitlamp. Kurz also describes two patients who had retinal cysts in the periphery of the fundus without retinal detachment. One of these patients had an idiopathic cyst without any symptoms, the other had signs of a healed chorioretinitis in a myopic eye. The inflammatory process was held responsible for the cyst formation due to nutritional disturbances in the retina. The theories involved in the question of the formation of retinal cysts are discussed. Cystoid degeneration of retinal tissue with rarification of cyst walls can lead to information of large cysts, but there are also certain hypertrophic processes, especially in young individuals, through which larger cysts become surrounded with connective tissue. Max Hirschfelder.

Lee, F. M. Intraocular parasitism. *West China Med. Bull.*, 1945, v. 2, June 15, p. 52.

There are few reports on the invasion of the interior of the eye by parasites. Two cases were encountered by the writer in the hospital. In one eye the worm was seen in the anterior chamber, which soon disappeared into the vitreous. In both instances there were general leucocytosis, eosinophilia and an increased sedimentation rate. Unfortunately, the worms were not identified. (References.)

China Medical Journal.

Malling, A. A case of pseudonephritic retinitis. *Acta. Ophth.*, 1942, v. 20, pt. 1, pp. 63-68.

The writer reports a case of optic neuritis in a man 33 years of age, whose vision in the left eye was rapidly reduced to perception of hand movements. There were papilledema of three diopters, fine hemorrhages on the disc, and a temporal hemianopsia. Two weeks later he developed a stellate figure in the macula, with isolated peripapillary hemorrhages—a picture resembling angiospastic neuroretinitis. The general examination, including spinal puncture and X-ray studies of the skull, were negative.

The possible pathologic processes which could explain the fundus picture are an optic neuritis close to the chiasm extending forward to the optic disc, a toxic lesion simultaneously involving the optic nerve and retina, and a central retinitis secondary to the optic neuritis.

Ray K. Daily.

Manschot, W. A. Synchysis scintillans. *Acta Ophth.*, 1942, v. 20, pt. 1, pp. 80-90.

A detailed report of a microscopic and chemical examination of the vitreous from an eye with primary synchysis scintillans. The findings confirmed the former observations that the scintillating vitreous bodies consist of calcium soaps. (6 illustrations.)

Ray K. Daily.

Porsaa, Kaj. Acute spontaneous and postoperative hypotony in retinal detachment. *Acta. Ophth.*, 1942, v. 20, pts. 3-4, p. 379.

The literature is reviewed with tabulation of the spontaneous and postoperative cases, and three cases are reported. They are cases of retinal detachment in high myopia, in which an

acute hypotony developed. In two of the eyes there was severe pain and injection. In all three the anterior chamber was deep, the aqueous cloudy, the iris green, and there were opacities in the vitreous. In two eyes there was also a green discoloration of the sclera. From a study of the reported histologic data the author concludes that the direct cause of the hypotony is a lesion in the choroid, and that acute hypotony occurs when in addition to the retinal tear there is a concomitant perforation of the choroid which permits free passage of fluid from the vitreous into the suprachoroidal space. Hemorrhages from the choroidal lesion could explain the greenish color of the iris and sclera, the cloudiness of the aqueous and the vitreous opacities. Detachment of the ciliary body, which had been found histologically in some cases might be the cause of the pain and irritation of the eyes. The occurrence of acute hypotony postoperatively in retinal detachment is an unfavorable prognostic sign. The author suggests that in places where the sclera is thin, particularly in myopic eyes, diathermy be applied with a weak current and fine electrodes, in order to avoid damaging the already stretched choroid and sclera.

Ray K. Daily.

Roe, Oluf. Blindness after loss of blood. *Acta Ophth.*, 1942, v. 20, pt. 1, pp. 48-54.

A man, 66 years of age, developed visual disturbances after a hemorrhage caused by a duodenal ulcer. The right eye was totally blind and the left eye had a loss of the lower half of the visual field, with a normal central visual acuity. From a review of the literature, the author concludes that the visual loss is caused by ischemia, acidosis, and illumination. The acidosis, which

reduces the buffer capacity of the cells, probably occurs more readily in patients in a poor general condition, and it is in such patients that visual disturbances are apt to occur. The increased glycolysis in the retina produced by illumination contributes to cell injury by adding to the hydrogen-ion concentration. The increased exposure to light as the patient recovers from shock may account for the onset of the visual disturbance a few days after the hemorrhage, when the general condition of the patient is improving. Patients with anemia after loss of blood should have their eyes protected from light, and the study of the pupillary reactions as a part of a routine examination should be avoided.

Ray K. Daily.

Streiff, E. B. Retinal circulatory abnormalities in the carotid-sinus syndrome. *Presse Méd.*, 1945, No. 39, Sept. 29, p. 522.

Streiff reviews the literature on the carotid-sinus syndrome and the relationship of the carotid sinus to the retinal circulation. He points out that in the normal individual, excitation of the carotid sinus (maneuver of Tschermak) provokes a bradycardia and a small drop in systemic and retinal arterial pressure without subjective sensations. In contrast, under the influence of pathologic factors, such as atherosomatous changes in the carotids or the sinus, tumors of the neck region, and goiter, the reactivity of the carotid sinus is markedly increased. Light compression then produces a considerable bradycardia and a strong drop in arterial pressure. There follows a series of subjective and objective difficulties which characterize the carotid syndrome and "carotid convulsion." Patients suffering from this syndrome complain of visual difficulties, includ-

ing foggy vision and the sensation of a black veil over the sight. This sensation appears to coincide with a marked drop in retinal arterial pressure.

The author refers to a patient, reported by Marcel, who had thrombosis of the central retinal vein. The blood pressure was normal but there was an arteriosclerosis and a hyperexcitability of the carotid sinuses. Streiff also reports a patient who had a macular edema with loss in vision and hyperactive sinus, and a patient with arteriosclerosis who had attacks of mental foginess followed by sudden loss in vision of the left eye; several weeks later the other eye developed an embolus of the central artery with loss in vision; the hyperactivity of the carotid sinus was a prominent feature. The author also mentions the patient of Kouretas and Djacos who had carotid-sinus overactivity and developed attacks of failing vision leading to total blindness.

Streiff mentions the possibility that in cases of so-called spasm of the central artery of the retina, hypotension induced by carotid-sinus activity may play an important role. He thinks that in the same way it is possible that thrombosis of the central retinal vein may be provoked by a drop in retinal arterial pressure. Carotid-sinus hyperactivity must be considered a major cause of retinal arterial hypotension. He concludes by stating that excitation of the sinus, according to the intensity of the pathologic reflex reactions, the state of the vessel walls in the brain and eye, and the degree of stasis in the capillaries and veins, can provoke a simple vertigo, a syncope, a stroke, and, from the ocular point of view, foggy vision, transient blindness, or severe retinal lesions.

Phillips Thygeson.

Suellmann, H. The glycolysis of glucose and fructose in the retina. *Ophthalmologica*, 1943, v. 106, Nov.-Dec., pp. 301-311.

The retina contains ferments which bring about glycolysis of carbohydrates. The isolated bovine retina produces anaerobically about a quarter as much lactic acid from fructose as from glucose. Increased fructose concentrations did not change this relationship, and lactic acid is formed from glucose even in the presence of high fructose concentration. The aerobic formation of lactic acid is greater than the anaerobic. However less lactose is produced from fructose than from glucose. The experiments showed no evidence for the supposition that the relatively small formation of lactic acid from fructose is due to a lesser permeability of the retina for this hexose.

Max Hirschfelder.

Wagener, H. P. Retinal lesions in acute disseminate lupus erythematosus. *Amer. Jour. Med. Sci.*, 1946, v. 211, Feb., p. 240.

The author reviews the literature and notes that in acute disseminate lupus erythematosus characteristic retinal lesions are found. They vary, however, according to the type of the systemic disease, in which vascular, inflammatory, toxic, or embolic features may predominate.

In the vascular type one finds papilledema with extension of the edema into and beneath the retina, retinal detachment and atrophy, guttate retinitis, perivascular exudates and hemorrhages, and choroidal degeneration. The hemorrhages and the soft fluffy exudates are perivascular and, like the papilledema, are due to transudation of fluid and not to intraocular pressure.

In generalized toxemia there may be small, fluffy, yellowish-white or white

spots in the superficial layers of the retina, usually in the posterior part of the fundus and very similar in appearance to the cotton-wool patches of hypertensive retinopathy. On histologic examination they were found to be areas of cytooid bodies. There also were small superficial hemorrhages in the retina which were not related to the white patches nor to the larger retinal vessels and slight papilledema.

In the inflammatory "septic choroiditis," round, white, elevated lesions resembling tubercles of the choroid were found.

In a patient with the embolic type, a bilateral secondary optic atrophy was found. The retinal veins were extremely narrow. Periarterial sheathing was present. Scattered throughout the posterior part of the fundus were numerous discrete punched-out areas of retinal atrophy bordered by a fringe of pigment and always near a retinal vessel. Histologic examination revealed atrophy and gliosis of the optic nerves and atrophy of the walls of the larger arterioles in the retina, with constriction of the lumen and degeneration of the media. In some places extensive perivascular fibrosis was present and produced discrete areas of retinal atrophy.

R. Grunfeld.

Weber, Ernst. Biomicroscopic investigation of the anterior limitations of the vitreous and its connections with the lens. *Klin. M. f. Augenh.*, 1942, v. 108, Nov.-Dec., p. 710.

The author describes the anterior limiting structures of the vitreous as they are seen in biomicroscopy. His studies confirm histologic findings of Wiegiers (1883). The hyaloid, which is essentially a condensation of the vitreous where this structure is in contact with the retina, becomes a free membrane of considerable stability in the

region of the ora serrata. Following the terminology introduced by Vogt, it is here called the vitreous lamella and is easily distinguished from the zonular fibers as it crosses over the posterior surface of the lens and becomes attached to its capsule 1 mm. from the edge. At the site of the attachment the membrane becomes slightly thickened and forms a ring which is ophthalmoscopically demonstrable just inside the maximally dilated pupil. Inside this ring the tissue of the vitreous lamella becomes more delicate and is called the plicata, which is identical with the anterior limiting membrane of the vitreous. Although it is almost indistinguishable from the vitreous structure in the senile and myopic eye, it can usually be identified in young healthy eyes. It is extremely variable in form and structure and readily swirls in extreme convolutions during slight movement of the eyeball. It comes to rest behind a small retrolental space when the eyeball and lids are quiet. These structures are most easily seen in the lower quadrant, but can also be demonstrated in the horizontal diameter by changing the beam of the slitlamp to its horizontal position. (1 plate, diagrams.) F. Nelson.

Zeeman, W. P. C. The ophthalmoscopic picture of a retinal glioma. *Acta Ophth.*, 1942, v. 20, pts. 3-4, pp. 213-221.

The ophthalmoscopic and microscopic appearances of a retinal glioma are correlated. (12 illustrations.)

Ray K. Daily.

11

OPTIC NERVE AND TOXIC AMBLYOPIAS

Ector, L., and Bégaux-van Boven, C. Glaucoma and papilledema. *Ophthalmologica*, 1944, v. 108, Sept., pp. 113-120.

The factors which play a part in the development of papilledema are an increase of the pressure of the cerebrospinal fluid, increase of the pressure in the intracranial veins, increase in the arterial pressure, decrease of the osmotic pressure of the blood, and decrease of the intraocular pressure. The authors observed a case of bilateral papilledema due to meningeal tumor. During the course of observation the patient developed glaucoma in one eye. The papilledema promptly disappeared in this eye but continued in the fellow eye. Max Hirschfelder.

Pacheco Luna, R. Blindness caused by therapeutic doses of quinine. *Arch. de la Asoc. para evitar la Ceguera en Mexico*, 1945, v. 3, p. 97.

This rare condition has been encountered only three times by the author in the decidedly malarial country of Guatemala. He believes, however, that less severe ocular disturbances caused by quinine therapy, may occur and remain unperceived by the general practitioner. In the author's three cases the symptoms suggest that retinal damage occurred because the patient was sensitive to therapeutic doses of quinine, rather than poisoned by large doses, such as are given in criminal abortion. When ocular disturbances occur during the course of antimalarial treatment, it is advisable to stop quinine at once and substitute atabrine and plasmoquine. One should also begin energetic vasodilation, with acetylcholin or amyl nitrite, followed by vitamin A. This course of medication is indicated even when central vision is greatly reduced and the visual field much contracted. When all treatment has been in vain, sympathectomy has given surprising results on a few occasions.

Jerome B. Thomas.

NEWS ITEMS

Edited by DONALD J. LYLE, M.D.

904 Carew Tower, Cincinnati 2

News items should reach the editor by the twelfth of the month

DEATHS

Dr. John H. Acheson, New York, New York, died January 18, 1946, aged 70 years.

Dr. Waid E. Carson, Pittsburgh, Pennsylvania, died April 10, 1946, aged 69 years.

Dr. Eugene E. Holt, Jr., Portland, Maine, died February 2, 1946, aged 60 years.

SOCIETIES

At the March dinner meeting the members of the Cleveland Ophthalmological Club were the guests of the ophthalmological department of the Cleveland Clinic. Dr. A. D. Ruedemann, chief ophthalmologist, with his associates, Drs. Kennedy, Mathieson, and O'Connor, presented a most interesting and instructive clinical program.

At the April dinner meeting, Cleveland ophthalmologists who had recently returned from military service were the guests of Dr. Paul Motto, club president. Speakers who described their experiences in ophthalmology in the Army and Navy were: Dr. W. P. Chamberlain, Jr., Dr. W. H. Evans, Dr. R. J. Kennedy, Dr. J. E. L. Keyes, Dr. George King, Dr. Irwin Stolz, and Dr. Benjamin Wolpaw.

The Milwaukee Oto-Ophthalmic Society held its regular meeting on April 23d. Dr. Douglas Buchanan, University of Chicago, presented a paper, entitled "Ocular manifestations of intracranial tumors in children and adults."

Among the speakers at the 1946 session of the Louisiana State Medical Society, held May 6th to 8th, was Dr. Francis W. Raggio, Jr., who spoke on "The management of common eye injuries in the general practitioner's office."

At the eighty-seventh session of the Kansas Medical Society, April 22d to 25th, Dr. H. Rommel Hildreth discussed "Tear-sac surgery."

The 106th meeting of the Illinois State Medical Society was held May 14th to 16th at the Palmer House, Chicago. Among the speakers were: Dr. Paul Carelli, Chicago, "Relation of near-point convergence to squint surgery;" Drs. Watson Gailey and George E. Morgan, Bloomington, "The surgical management of squints;" Dr. H. S. Sugar, Chicago, and Harvey J. Forestner, D.D.S., Chicago, "Methacrylic-resin implant for sunken upper lid following enucleation;" Dr. Helen Holt, Chicago, "Ocular observations in deficient diets;" Dr. Samuel J. Myers, Chicago, "Diagnosis and treatment of

blepharoptosis;" Dr. Edmund B. Spaeth, Philadelphia, "The Marcus Gunn jaw phenomenon;" Dr. Thomas D. Allen, Chicago, "Pan-American Ophthalmological Congress in Montevideo;" Dr. Oscar B. Nugent, Chicago, "Cataract extraction by the vacuum method;" Dr. Kenneth L. Roper, Chicago, "Lancaster's technique of cataract extraction," and Dr. Bertha A. Klien, Chicago, "The eyegrounds in the differential diagnosis of arterial hypertension."

MISCELLANEOUS

The Eye Bank for Sight Restoration, Inc., recently announced the awarding of seven scholarships to ophthalmologists for training in the technique of the corneal-grafting operation, and the establishment of two fellowships to carry on research in blindness resulting from corneal damage. The ophthalmologists who received the scholarships are all trained eye surgeons, certified members of the American Board of Ophthalmology, recognized in their field, and veterans of the past war. They will receive their training at the Corneal Research Laboratory, located at the headquarters of the Eye Bank at 210 East 64th Street, New York. (See page 746.)

The doctors who received the awards are:

Dr. John A. Cetner, assistant attending ophthalmologist at the Albany, New York, Hospital, and instructor in ophthalmology at the Albany Medical College.

Dr. Fred Sauter, chief refractionist at the Brooklyn Eye and Ear Hospital.

Dr. Henry L. Birge, who specialized in eye work at the Mayo Clinic.

Dr. Maurice Croll, a captain in the Army, chief of the eye, ear, nose and throat departments of various station hospitals.

Dr. Milo H. Fritz, a major in the Army, now stationed at the Valley Forge General Hospital at Phoenixville, Pennsylvania, and who, after discharge, will become a member of the Dartmouth Medical School's department of ophthalmology.

Dr. Earl H. Merz, a captain in the Army, stationed at the Valley Forge General Hospital.

Dr. Alston Callahan, a former Army captain, who has just been appointed to the chair of ophthalmology at the University of Alabama Medical College in Birmingham.

Of the two scholarships, one was established from the funds of the Eye Bank. It was awarded to the New York University Medical

School, to be used by Dr Donald Hughson of the Bellevue Hospital's department of ophthalmology, under the direction of Dr. Daniel Kirby, professor of ophthalmology, for experimental work in corneal grafting.

The other, a fellowship of \$2,650, given by the Milbank Memorial Fund to the Eye Bank for the study of the vascularization of the cornea, has not yet been awarded.

BOOKS—WAR VICTIMS

During the war, the libraries of half the world were destroyed in the fires of battle and in the fires of hate and fanaticism. Where they were spared physical damage, they were impoverished by isolation. There is an urgent need—now—for the printed materials which are basic to the reconstruction of devastated areas and which can help to remove the intellectual blackout of Europe and the Orient.

There is need for a pooling of resources, for coordinated action, in order that the devastated libraries of the world may be restocked as far as possible with needed American publications. The American Book Center for War Devastated Libraries, Inc., has come into being to meet this need. It is a program that is born of the combined interests of library and educational organizations, of government agencies, and of many other official and nonofficial bodies in the United States.

The American Book Center is collecting and is shipping abroad scholarly books and periodicals which will be useful in research and necessary in the physical, economic, social and industrial rehabilitation and reconstruction of Europe and the Far East.

The Center cannot purchase books and periodicals; it must depend upon gifts from individuals, institutions, and organizations. Each state will be organized to participate in the program through the leadership of a state chairman. Other chairmen will organize interest

in the principal subject fields. Coöperation with these leaders or direct individual contributions are welcomed.

What is needed. Shipping facilities are precious and demand that all materials be carefully selected. Emphasis is placed upon publications issued during the past decade, upon scholarly books which are important contributions to their fields, upon periodicals (even incomplete volumes) of significance, upon fiction and nonfiction of distinction. All subjects—history, the social science, music, fine arts, literature, and especially the sciences and Technologies—are wanted.

What is not needed. Textbooks, out-dated monographs, recreational reading, books for children and young people, light fiction, materials of purely local interest, popular magazines such as *Time*, *Life*, *National Geographic*, etc., popular nonfiction of little enduring significance such as Gunther's *Inside Europe*, Haliburton's *Royal Road to Romance*, etc. Only carefully selected federal and local documents are needed, and donors are requested to write directly to the Center with regard to specific documents.

How to ship. All shipments should be sent prepaid via the cheapest means of transportation to The American Book Center, c/o The Library of Congress, Washington 25, D.C. Although the Center hopes that donors will assume the costs of transportation of their materials to Washington, when this is not possible reimbursement will be made upon notification by card or letter of the amount due. *The Center cannot accept material which is sent collect.* Reimbursement cannot be made for packing or other charges beyond actual transportation. When possible, periodicals should be tied together by volume. It will be helpful if missing issues are noted on incomplete volumes.

K. R. Shaffer, Executive-director



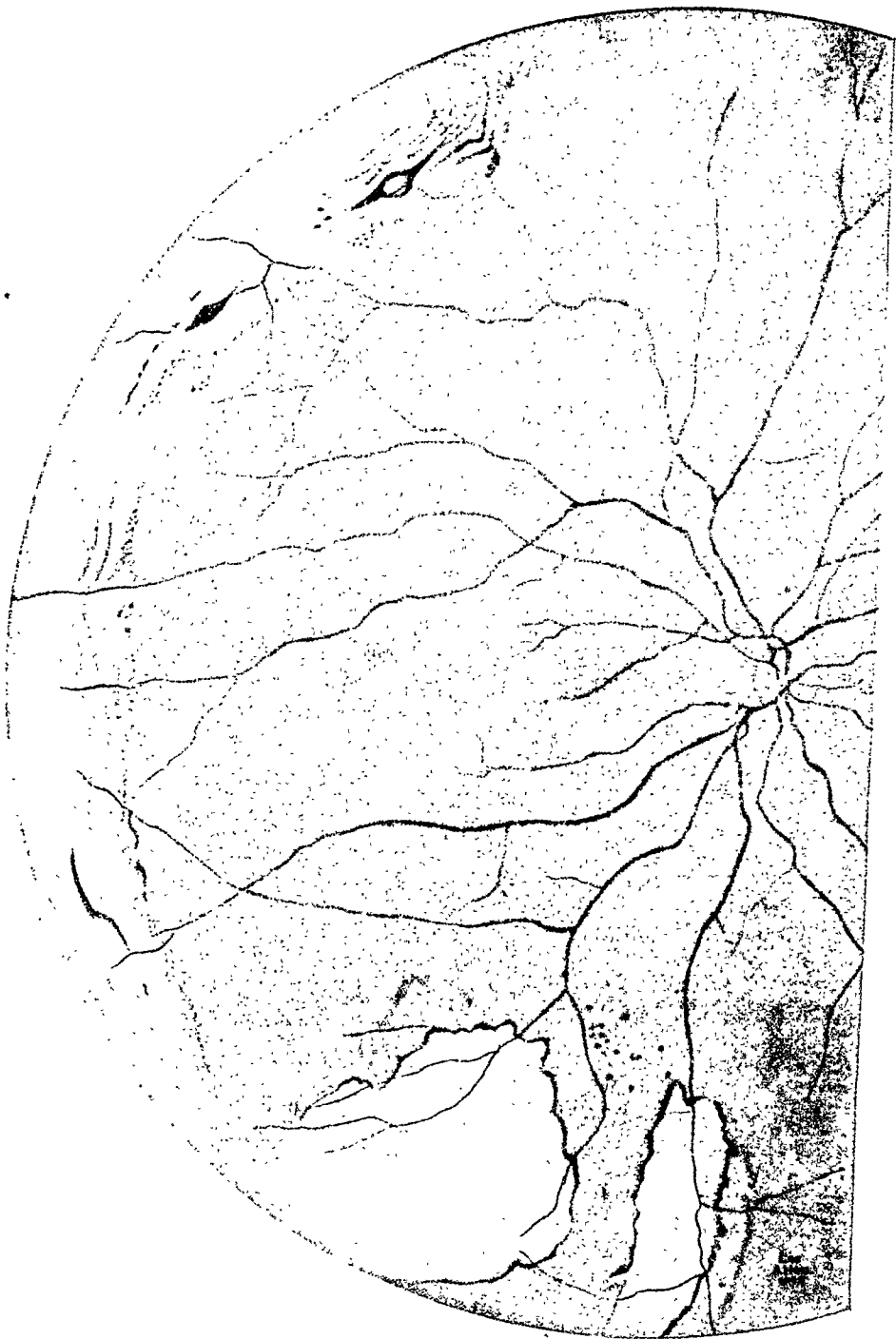


FIG. 8 (VAIL). FUNDUS OF THE RIGHT EYE TWO MONTHS AFTER OPERATION

THE SCLERAL-RESECTION (EYEBALL-SHORTENING) OPERATION*

DERRICK VAIL, M.D.

Chicago

Before developing the thesis of this address, I should like to try to express my gratitude and humble thanks for the very great honor of being invited to give the de Schweinitz Lecture in the year of victory over our enemies and before this distinguished group of friends and colleagues. I have never approached a task with more diffidence and humility than I have this present one. How can one adequately pay tribute to the many-sided man whose name this lectureship bears? How can one sufficiently express his appreciation for this genius of our time, whose qualities, talents, and kindly influence live in our thoughts and deeds, whose monument is everywhere in our libraries, in our daily work, and in our hearts? There is no one who deserves more respect and admiration than this man of kind manners, the ophthalmic surgeon of exquisite delicacy, the master of neatness and tidiness in his work, the leader of ethical practice, the beloved preceptor of notable pupils, and the author of numerous and living contributions of note to our science. Those of us fortunate to have known him, be it ever so slightly, will always recall with deep affection the figure and charm of his princely person, his personality, his strong character, his help, and his skill, and above all, his

polite and courteous attention to our own individual problems that we brought or sent to him, never in vain and never without profit to our patients and to ourselves.

But the debt that I owe him is still more personal. Out of the pages of his writings, his wisdom has guided me and has solved many problems for me during these war years of great responsibilities in an unfamiliar assignment. I should like to take this opportunity to speak for a few moments of the medical officer, Brigadier General George E. de Schweinitz, Chief Consultant in Ophthalmology to the Surgeon General during the first World War. His writings and reports on ophthalmology contained in the History of the Medical Department in the World War, published by the War Department in 1924, were the first things I sought out on entering the Army and were ever at hand for reference.

On October 11, 1917, the then Lieutenant Colonel G. E. de Schweinitz, M.R.C., received confidential orders No. 92, W.D. par. 10, requesting him to proceed overseas on an inspection trip to study the problems of ophthalmology in the Medical Corps and to report his findings and recommendations to the Surgeon General. In the company of several other officers in the Office of the Surgeon General, he left on October 29, 1917, and returned on March 1, 1918. Col. Allan Greenwood, M.R.C.,⁴ the Senior Consultant in Ophthalmology to the Chief

* The de Schweinitz Lecture. Delivered before the Section on Ophthalmology of the College of Physicians, Philadelphia, November 15, 1945. From the Department of Ophthalmology, Northwestern University Medical School.

Surgeon, A. E. F., in his "History of ophthalmology in the A. E. F.," published in the same volume, pays this tribute: "Before the arrival of a large number of American troops in France a most helpful and important stimulation toward an improvement in the ophthalmic service in the A. E. F. came about through the observation visit to France and England of several officers from the Office of the Surgeon General. The encouragement given to the young men and the recommendations to the Chief Surgeon and the Surgeon General as a result of this visit were the real start of the Ophthalmic Service of the A. E. F." I can add with truthfulness "and were the real start of the Ophthalmic Service of the E. T. O.," as I hope to show you.

Lieutenant Colonel de Schweinitz, before seeing the American units, visited and observed the British Eye Service in France, both at the front and at the base. He was impressed with the efficiency with which the eye patients were handled, particularly with the speed with which prescriptions for spectacles were filled, often within 15 minutes, even in the front lines. He studied the British methods and equipment, found much to praise, and detected some flaws there which he endeavored to correct in our own Service. His recommendations, although not entirely carried out, resulted in an Ophthalmic Service in the A. E. F. that was second to none. Had his original recommendations been followed to the letter at the time of our preparation for war in 1940 or even as late as 1941, much of our troubles and many of the problems that we later encountered in the E. T. O. and other theaters would have been avoided. But I think that the War Department suffers a chronic form of Korsakoff's syndrome, particularly a loss of memory for the lessons of recent wars. In this instance, at any rate, it forgot the ophthal-

mic experiences of the last war and muddled into the same errors, fortunately not entirely too late for correction in the E. T. O.; very late, however, for the M. T. O., and almost too late for the Pacific Theater.

Colonel de Schweinitz recommended that one ophthalmic surgeon be stationed in each evacuation hospital. In this war it was not done until the lessons of the African Campaign had been bitterly learned. By the time the Table of Organization of an Evacuation Hospital, which is a front-line establishment, had been officially changed to include an ophthalmic medical officer, there was a grave shortage of officers. It was another example of "too little and too late." One had to be content with what could be scraped up, and the ophthalmic care of the wounded soldier in the Army areas was, perhaps, not so good as it might have been. There was no provision for the placement of an enlisted man trained as a practical optician in an evacuation hospital. Our officers searched their detachments and generally came up with an optometrist or optician whom they wangled into helping them in the eye clinic.

Colonel de Schweinitz recommended, too, that optical shops be established not only in the base of the eye centers but also in the forward areas. These optical shops were to be equipped with round frames and stocked with preground round lenses that only required edging for speedy insertion. Our system of issuing oval lenses and fancy frames, together with round gas-mask insert lenses—in other words, two types of lenses—was a clumsy one and led to many difficulties. After several years of bitter frustration the situation was eased, but never became entirely satisfactory in any theater of operation. The development of auxiliary or portable optical repair units was slow and late. But I must say that

those that arrived were well used. This is a lesson we could have learned early from Dr. de Schweinitz's report.

Among his recommendations was one advising the encouragement of ophthalmic research. It was fruitful in the last war. It has influenced the policy along this line in this one, and the results of this encouragement are now apparent in our journals.

His most important recommendation was that of placing a chief consultant in Ophthalmology in the Chief Surgeon's Office. It is a matter of history now how valuable this was in the last war, and it is written for all to see. It could have been read in 1940. In this war, no authorization for such a position was ever made. In the E. T. O. the consultants in the medical and surgical specialties were appointed at the specific request of General Paul Hawley, the Chief Surgeon, and charged against the allotment of officers on his staff. No other theater of operations had these consultants. In the Mediterranean Theater the Chief Surgeon was compelled by circumstance to utilize the services of Major Trygve Gundersen (MC), in this capacity and on an informal basis. Without the recognition that should go with the importance of the post or the grade the position required, Major Gundersen did a splendid job and cleaned up a mess for which he has received little credit and no promotion. No consultant in ophthalmology was appointed in the Pacific Area until a few weeks before V-J Day, when Lt. Col. James Greear (MC) was chosen. He was about to sail when victory was won. There were many ophthalmic problems in that theater crying for solution up to the very end. Nor was it until the spring of 1944 that a Chief Consultant in Ophthalmology, Major Elliott Randolph (MC), was appointed to the Office of the Surgeon General. From the beginning

of the prewar preparations in 1940 until then, ophthalmic policies and plans were kicked around more or less haphazardly in the Office of the Surgeon General and referred to medical officers who were not ophthalmologists nor in some cases particularly interested. Major (now Lt. Col.) Randolph's appointment was a great success and he handled very efficiently the ophthalmic problems that came up.

Colonel de Schweinitz reported on the lack of equipment, particularly perimeters. The Supply Division of the Army Medical Department is allergic to perimeters and the lack of equipment is a perennial cause of complaint. Very few perimeters or slitlamps were provided the overseas units in this war either.

The results of Dr. de Schweinitz's report became apparent in early 1918. A Chief Consultant (Colonel Greenwood) was appointed to the staff of the Chief Surgeon, A. E. F., the equipment improved, base optical shops and auxiliary optical shops were developed, and eye centers established which functioned well and capably.

The reading and studying of this report was of inestimable value to me in my capacity as Senior Consultant in Ophthalmology in the E. T. O. The hints, clues, and specific recommendations guided me at a time when no other source of help was available. The ophthalmic services in the E. T. O. were improved accordingly. So you can see why my personal gratitude to the guiding hand of George E. de Schweinitz, as revealed in the pages of a book, is most profound.

His chapter on "Ophthalmology in the United States" in the same volume is a masterpiece of assembling and presentation. Those of you who have read it will recall the eloquence of the writing, the same policies of treatment, the orderly arrangement of text and illustration, and

the valuable and lively descriptions of specific cases of war injuries. Increase the number of cases and alter the statistics upward, and the chapter would give us the ophthalmic lessons of this war. The historical and prophetic sense exhibited here is another side of Dr. de Schweinitz's genius that should, some day, be further explored to the great benefit of our profession.

Therefore, if I have succeeded in this exposition in picturing to you and calling to mind but a small part of the enormous contribution that Dr. de Schweinitz has made in the field of war ophthalmology alone, my debt to his memory will have been partially discharged.

I have been much tempted to devote this lecture to a review and discussion of the work done by Dr. de Schweinitz in the last war and continue the parallel description of ophthalmic matters and policies in this one. I am quite sure that the honors would remain with Dr. de Schweinitz and his group in spite of the fact that this war was a much greater venture. I am also quite certain that the ophthalmic care of the sick and wounded was better in this war than in the last, but only because of the better professional training of the ophthalmic medical officers as a group compared with the ones in the last war, and in spite of more or less muddled planning.

However, I think that we are all fed up for the time being with war topics and discussions of military matters and war medicine. Perhaps later on our appetite for these subjects will return. I, for one, would, therefore, prefer to discuss a small subject in the field of ophthalmic surgery. It is one, I think, that would have interested Dr. de Schweinitz were he here today, for one of the facets of his many-sided character was his keenness for and skill in all aspects of surgery pertaining to the eye.

HISTORY OF SCLERAL RESECTION

Scleral resection was introduced in 1903 by Leopold Müller¹⁰ of Vienna and was originally designed for retinal detachment in patients with myopia, usually of high grade. Müller considered that the cause of the retinal detachment in these cases lay in a stretching of the sclera at the expense of the retina. It logically followed, therefore, that he should try to shorten the globe and thus bring the sclera to the retina. It is not clear from reading his description just how he expected the retina to stay in place, for nowhere do we find him discussing adhesive choroiditis.

He selected for operation those cases of detachment that had persisted for a year or more without improvement. In his early cases he performed the Krönlein operation in order to expose the temporal aspect of the eyeball, choosing this area arbitrarily because of its relatively easy access. In answer to a question raised in a discussion of the operation as to why he chose the temporal part of the eyeball and not the area of the greatest detachment, Müller said that he performed the operation only when the entire retina was detached. He later abandoned the Krönlein operation, replacing this step by an external canthotomy.

His first patient was operated upon in 1903. The case was that of a man with myopia of 9 diopters in his only useful eye. Retinal detachment occurred and was treated medically for some time, without success. After doing a Krönlein operation and a tenotomy of the superior, external, and inferior recti muscles and exposing the operative field of the eyeball, Müller resected an oval piece of sclera 8 to 10 mm. in width and 18 to 20 mm. long from the temporal side of the eyeball. The patient was operated on under general anesthesia; subsequent authors referred to

it as lengthy and formidable. The anterior border of the resected area was 1 to 2 mm. behind the insertions of the muscles, and the posterior border was in the neighborhood of the equator. The postoperative recovery was uneventful, and the case was considered a success in that the vision was restored to ability to count fingers at 3 meters, the retina was back in place, and the periphery of the field of vision was full. The poor vision was due to a central scotoma as the result of old chorioretinitis.

Three other cases were mentioned by Müller at this time, but the details were not given. Although the exact technique that Müller followed is not described in his original presentation, one can gather a very good idea from a study of subsequent papers by various authors, especially one by Lenz.⁷ Silk sutures were placed prior to excision and tied as the operation proceeded. Müller writes of the care that is needed to avoid injuring or rupturing the choroid as it is exposed, and of the danger of serious hemorrhage and loss of vitreous. With a fine knife, he punctured the choroid as it lay exposed, thus releasing subretinal fluid and permitting the choroid to be tucked in as the sutures were tied.

In 1913, Müller¹¹ reported two cases of retinal detachment cured by scleral excision and mentioned that he had done the operation on 19 patients.

Between 1903 and 30 years later, when Lindner⁵ revived interest in the operation, there appeared sporadic case reports and articles in the literature, all of which were European. The interesting thing to me in the study of these reports is the paucity of details regarding the operative technique itself or the results, which on the whole were not good. Dr. Leopold¹² of Philadelphia, in discussing a recent paper by Pischel, remarked that he had collected 121 cases of scleral resection

from the literature, in 25 of which there was successful reattachment and in 31 of which partial or temporary reattachment; the rest presumably were failures. This represents cures of about 20 percent, which, considering the types of cases in which the operation is usually performed, is, to my mind, brilliant.

As is well known, Lindner in 1933 modified Müller's technique. He reported operating 23 times on 12 eyes which, with few exceptions, were associated with myopia. He thought that the best results were to be obtained in those cases in which he removed a piece of sclera from the entire circumference of the eyeball in two operations, or in those cases wherein the detachment of the retina occurred in aphakic eyes.

The technique described by Lindner was used for the first time in this country by D. K. Pischel.¹³ He and Miller reported the successful case in detail and gave a full analysis of the technique which I should like to quote here.

The sclera is laid bare, and one rectus muscle is cut off. Specially equipped dividers are needed, one leg of which has a dull point and the other a sharp blade. A line concentric with the limbus and 9 to 10 mm. from it is lightly cut in the sclera by drawing the dividers over it, the blunt end being kept on the limbus and the blade end in the sclera. Next, a second line is cut posterior to the first one, in a similar manner, the blunt end of the compass being kept on the first cut and a new cut being made with the blade end. These two incisions should be from 2 to 6 mm. apart.

The incisions are deepened with a keratome through three quarters of the scleral thickness. Care must be taken not to perforate the sclera and choroid, as the eyeball may collapse or a severe hemorrhage may occur. Double armed fine chromic catgut sutures are placed 2 mm. apart through both peripheral lips of the incisions (in the form of a mattress suture), leaving the flap free. These sutures should be placed at this time for it is difficult, if not impossible, to do so after the piece of sclera has been entirely excised. After the sutures are in place, the crescent of sclera is slowly cut out. First, the two parallel incisions are joined at one end, and then with a fine scissors the remaining layers of scleral fibers at this end are cut through

leaving the choroid bare. Care must be exercised to see that the choroid is free from the sclera. When 2 to 3 mm. have been cut through, the first set of sutures is carefully tied, care being taken that the choroid is not caught in the lips of the sclera as the sutures are drawn up. The free end of the flap of sclera is drawn under the other sutures and the flap is cut through farther along, the sutures again being tied as more choroid is laid bare. As the process continues and the globe becomes smaller, the choroid will be bulged out through the incision by the pressure from within. The choroid must be punctured with a fine discission needle and some of the intraocular fluid be allowed to escape. [Borley¹ in one of his papers mentions the value of repeated paracentesis during the operation at this stage in order to prevent too rapid and too much herniation of the choroid.] The choroid can then be tucked back inside the sclera. In making the puncture one should avoid large choroidal vessels, as otherwise disturbing hemorrhage may occur. After the crescent of sclera has been completely excised and the last scleral suture tied, the cut muscle may be re-sutured, and the conjunctival incision closed. In cases in which former operations had been performed, the choroid will be found adherent to the sclera. Here a thin layer of scleral tissue may be left behind.

In his most recent paper, Pischel¹² enlarges on the technique and mentions that it is advisable to touch the choroid, at least where punctures are to be made, with a 3-percent potassium-hydroxide solution, and wash off any excess. He goes on further to say:

Experience has shown several points worthy of emphasis. When operating too soon after previous surgery, the sclera will be found to be boggy. Sutures pull out easily and an unexpected scleral perforation can occur. In re-operated areas, adhesions of Tenon's capsule to the sclera are very troublesome, and cause considerable bleeding which must be controlled. Here, also, care must be taken not to cut into the sclera when dissecting blindly. Vortex veins may interfere with the desired placement of the lines of incision and necessitate varying the symmetry of these. Sometimes a thin layer of scleral tissue in which vortex veins are imbedded can be left and folded inward, as in choroido-scleral scars. Cutting such a vein exteriorly causes hemorrhage difficult to control, but cutting it internally may cause devastating intraocular hemorrhage.

He discusses the difficulties and dangers

of the operation and continues on to give valuable hints on how to avoid them. This article is most noteworthy, for it not only presents the technique of the operation and case reports by an author of experience, but the description is followed by a most enlightening discussion. It should be read in its entirety by all who are interested in the subject.

RECENT AND PERSONAL CASE REPORTS

Scleral resection has been employed successfully in (a) cases of retinal detachment, (b) cases of high myopia, and (c) cases of scleral staphyloma with and without retinal detachment.

RETINAL DETACHMENT. The recent literature, since Lindner's article appeared in 1933, is not rich in case reports and studies, although it is entirely possible that the operation has been performed more often than reported. For example, in 1940 I performed a scleral resection on a woman whose only eye was aphakic and on whom two previous diathermy operations had been done without success. The retina was reattached, and the corrected vision restored to 20/70. In 1941, as a last resort, the operation of scleral resection was done three times on the only eye of a young man who had a complete detachment but no real improvement followed, although the eye stood the operations surprisingly well. These cases were not reported at the time because it was desired to accumulate more cases and experience before presenting the material. This is very likely the experience of other surgeons.* Pischel¹²

* Since the preparation of this paper it was learned that Dr. D. W. Bogart of New York presented a paper before the New York Society for Clinical Ophthalmology, on October 1, 1945, discussing the surgery and his results on 18 cases of scleral resection for retinal detachment. He very kindly sent me notes of his paper, which has not yet been published. His operation

and Borley² have each reported their results in a small series of cases, and the record, on the whole, is good when one considers the desperate nature of the cases chosen. For example, there is the brilliant result obtained by Pischel in his second case, which I should like to cite in full detail. It emphasizes the premise that one should not give up in retinal surgery until all is hopelessly lost. Pischel's dogged determination and the patient's fortitude brought about an astounding cure.

A young man, aged 30, had had congenital cataracts needled innumerable times. The right eye was finally lost. A last operation on the left eye, apparently pulling out a dense membrane, gave him about 10/200 vision with ability to read typewritten copy with a magnifier. In July, 1940, he was sent to me (Pischel) because of a retinal detachment in the nasal superior quadrant. Briefly, examination showed an aphakic eye, eccentric pupil, moderate oscillatory nystagmus, and a detachment of the retina in the nasal superior quadrant. It was necessary to give avertin anesthesia to stop the nystagmus so that a reasonably complete fundus examination could be made. A small doubtful tear was seen toward 10 o'clock.

The first operation was a Lindner undermining, with the result that the detachment spread to the whole nasal half. The second operation was a diathermy coagulation of the original region. This resulted in spread of the detachment to include the entire lower half as well.

consisted, briefly, of the excision of a piece of sclera 5 by 12 or 14 mm. near the equator in the area of the detachment. A specially designed caliper was utilized to mark off the area. The incision down to the choroid was made with a specially designed knife. Following the closing of the wound, the surface over the area operated upon was "coagulated" by using a suitable spatula heated in an alcohol lamp. Eighteen eyes were operated upon; 39 percent were cured; 39 percent showed 80-percent cure; 15 percent showed from 25- to 40-percent cure; and one out of 18 was a failure. In other words, 78 percent of these 18 eyes showed from 80- to 100-percent cure. Ten of the 18 eyes were aphakic. It is to be noted that all 18 eyes were considered inoperable by the usual methods. Ten of them had had previous operations, and three had had as many as three operations.

The third operation, undertaken too soon, resulted in an unexpected perforation through the boggy sclera, with a gush of watery brown fluid, allowing the eye to collapse. The fourth operation, undertaken two months later, was an eyeball shortening of the whole lower half of the globe, a 3 mm. wide crescent being cut out. At the same time the site of the tear was again treated with diathermy coagulation. Convalescence was uneventful. Ten days post-operatively the patient stated that he saw better. Two weeks later a fundus examination showed the retina everywhere to be less elevated. Conditions improved and the patient finally recovered 6/200 vision with the retina everywhere in place. The visual field was normal. This condition prevails . . . over four years later.

I believe that there is not enough statistical data in the literature as yet to give us more help than we already have. The cases prior to 1930 ought to be discarded in such a study, because the modern knowledge of the surgical treatment of retinal detachment began at about that time. Lindner's paper (1933) focused our attention on the main principles of scleral resection, and the relatively few cases reported by him, Pischel, Borley, and others since that date are suggestive and promising only. One cannot praise these pioneers too highly. I wish, therefore, to emphasize the point that scleral resection is an operation that is feasible and offers some hope of success, even in extreme instances. There are many problems that still need to be ironed out. For example, we need to know more about what happens to an eye after scleral resection. Animal experiments offer a fertile field for study here. Technical details will improve and new instruments will be devised that will help shorten what is now an arduous and long operation.

HIGH (MALIGNANT) MYOPIA. A paper by W. E. Borley and O. R. Tanner¹ in a recent issue of the American Journal of Ophthalmology had for its title "The use of scleral resection in high myopia." This, so far as I know, is the first time

that such a title has appeared in the literature. The authors mention that Müller, Elschmig, Lindner, and Pischel have reported cases. Hildesheimer⁵ also reported attempts made by Arlt, Wolfe, Perinaud, and Galezowski to relieve high myopia and to improve or to prevent retinal detachments in myopic eyes by scleral resection. Holth⁶ did what he called "Trepanato sclerae prae-aequatorialis" in two cases of high myopia in which no retinal detachment existed, claiming good results although he mentioned few details and gave no report on vision. In four cases (two with retinal detachment) of high myopia, the myopia decreased from 12.0 to 5.50 diopters, 17.0 to 6.0 diopters, 16.0 to 10.0 diopters, and 18.0 to 5.50 diopters. His operation consisted, briefly, of using a 2.5-mm. Bowman trephine to bore a hole in the sclera to the choroid, about 12 mm. from the limbus between the external and inferior recti muscles. He then used his 2-mm. scleral punch, after first passing a spatula between sclera and choroid, backward in a meridional direction, and removed a piece of sclera 1.8 by 1.5 mm.

In 1937, Hildesheimer, using an electrocautery in the form of a loop, excised a piece of sclera for the reduction of myopia in two cases of unilateral high myopia, with good result and with a reduction in myopia in the first case from 31.0 to 20.0 diopters, and in the second from 15.0 to 13 diopters.

Borley and Tanner's case was that of a woman of 56 years. Prior to operation her refraction was: Right vision with $-17.75D.$ sph. $\approx -1.0D.$ cyl. ax. 80° was 15/200; left vision with $-18.75D.$ sph. sufficed for the perception of hand movements at two feet. The eyeballs were protruberant, and there were extensive choroidal changes and vitreous opacities, especially in the left eye. In January, 1941, the left eye was operated upon and a strip of sclera 2 mm. wide, 11 mm.

from the limbus from the 12- to the 6-o'clock position, was excised. The technique used was that previously described, with the addition of repeated paracenteses at about 5-minute intervals to allow the intraocular pressure to remain low. The postoperative course was uneventful. The same operation was performed on the right eye in June, 1941. There was slight but definite improvement up to January, 1943. In September, 1944, the corrected vision was: R.E., 15/70; L.E., finger counting at two feet. There was no change in the refraction, which is difficult to explain, and no change in the ocular fundi except for the heavily pigmented scar of the operation far temporally.

Pischel (1945) reported the case of a man, aged 55 years, with myopia of 17 diopters, whose vision in the right eye was 20/50; left eye, finger counting at three feet. A scleral resection was done on the left eye as a "training" move. Later, the same operation was performed on the good eye, a 3-mm. crescent of sclera being excised from the temporal half. The anterior chamber was repeatedly drained during the operations. Convalescence was uneventful. The author states that the distance vision changed little but the near vision improved. The change, if any, in the refractive error was not mentioned.

It is disappointing that here, too, more details are not given in these case reports. However, we do learn from them that the operation is possible and not particularly dangerous. Further studies will be stimulated. I believe that the operation does have a future in selected cases and it appears, on the surface at any rate, to be less hazardous to the eye than is the removal of a clear lens in these cases of high myopia.

SCLERAL STAPHYLOMA. 1. *The anterior (intercalary) scleral staphyloma.* In 1943 Gayer Morgan¹⁴ showed a patient before

the Ophthalmological Society of the United Kingdom upon whom he had successfully performed an excision of a ciliary staphyloma. The case was that of a young boy who had developed a ciliary staphyloma of the right eye, five years after glaucoma secondary to a needling operation for congenital cataract had developed. The conjunctiva was dissected off the posterior half of the staphyloma, conjunctival sutures were inserted and left loose. Mattress sutures were passed right through the staphyloma from the limbus to the healthy sclerotic behind the staphyloma by means of a large cutting surgical needle. It had been planned to evacuate a little fluid from the staphyloma, but enough escaped through the holes made by the needle, and the eye became reasonably soft. The sutures were then tied, and the staphyloma was snipped off. The preoperative astigmatism of 6 diopters was reduced to about 1 diopter. One attack of glaucoma had subsequently occurred, but the intraocular pressure was controlled by eserine. This successful case is a most impressive one, and the technique described is simple. The operation should be performed in all such cases which otherwise are hopeless and end in enucleation or perforation.

Although not quite in the same category, the case described by Spaeth¹⁵ might be mentioned here. A limbal staphyloma or ectasia followed a blow with a screw driver. The conjunctiva above the staphyloma was incised in a crescentic manner and mobilized for a large subsequent flap. The staphyloma was then opened with sharp scissors, and the iris prolapse was cleanly removed with de Wecker scissors. Two 6-0 waxed black-silk sutures were inserted in the edge of the corneal lip and passed into the bared scleral lip of the original corneoscleral incision, tied, and cut short. The conjunctival flap was then brought

over and sutured slightly past the midline of the cornea.

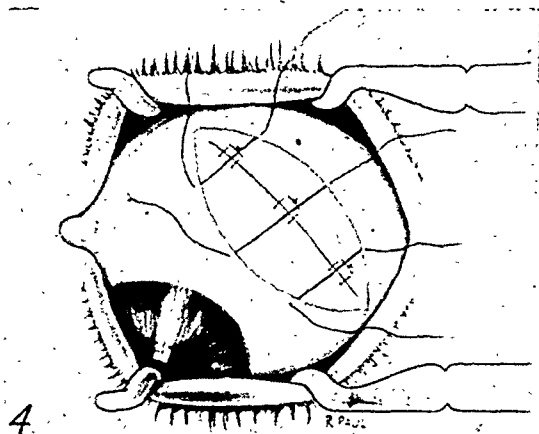
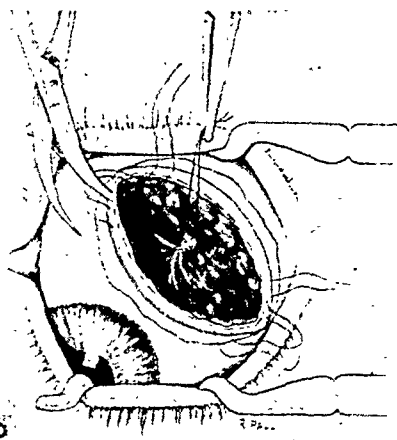
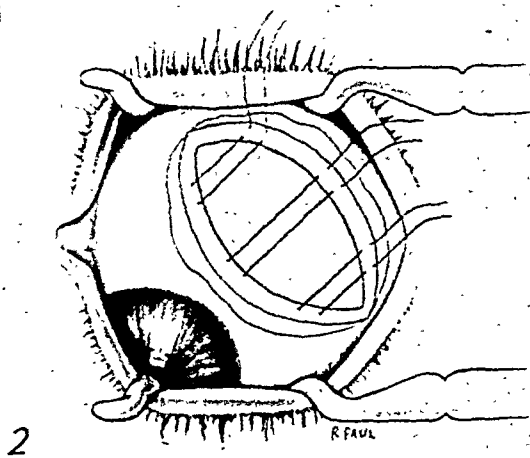
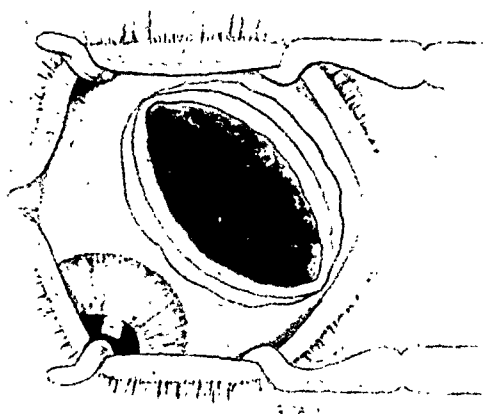
2. *Equatorial scleral staphyloma.* Before the American Ophthalmological Society in 1940, I reported¹⁶ a case of equatorial scleral staphyloma and retinal detachment cured by excision. The patient was a white woman, 57 years of age, who, on June 16, 1936, noticed a blur in the vision of the left eye which rapidly became worse. The right eye was normal. The examination showed a balloon detachment of the retina in the upper temporal area. When the overlying sclera was exposed in preparation for a diathermy operation, a large equatorial scleral staphyloma was unexpectedly encountered (fig. 1). It measured, roughly, 12 by 15 mm. and began abruptly at a point 6 or 7 mm. from the limbus. It occupied the area between the tendons of the superior and external recti muscles and, therefore, was obviously over the retinal balloon. Because of this situation, it was decided to excise the staphyloma in a method similar to the eyeball-shortening operation described by Lindner. In view of the subsequent events, I should like to describe the operation which was performed on June 29, 1936, in the exact words used in the case report. Two double-armed sutures were inserted along the edges of the staphyloma (fig. 2) and looped out of the way. A fixation suture was placed in the center of the ectasia. A Graefe-knife incision was made along the upper and inferior edges, and excision was completed with curved scissors (fig. 3). The fixation suture was of incalculable value at this point, for traction on it gave excellent control of the eyeball and of the portion being excised and, at the same time, created a negative pressure which prevented vitreous from spilling. Subretinal fluid and presumably fluid vitreous were lost, but, on completion of the excision, which included part of the retina, the main vitreous body could be

seen glistening clearly like water deep in a well. The sutures were quickly tied and a third was placed between them (fig. 4), thus bringing the edges of the wound tightly together and forming a small linear ridge of sclera.

The eye healed kindly, the retina was

sph. $\approx +1.75D$. cyl. ax. 115° , prior to the detachment, to $+1.75D$. sph. $\approx +5.25D$. cyl. ax. 25° , three years after operation.

The patient's son-in-law, who is a well-trained and keen ophthalmologist now in the Army, kept me informed from time



Figs. 1-4 (Vail). The scleral-resection operation. Fig. 1, Diagrammatic appearance and position of the staphyloma. Fig. 2, Showing the value of the fixation suture. Fig. 3, Diagrammatic drawing of position of sutures. Fig. 4, Showing closure of the wounds.

reattached, and, when the patient was examined three years later in preparation for the report of the case, the vision with correction was 20/40+ and J2 (fig. 5). The line of vision was "tented," owing to a slight disturbance in the macula. The refraction had changed from $-1.0D$.

to time regarding the condition of her eye, which remained good.

On April 28, 1945, she appeared at the Army hospital in which her son-in-law was stationed, complaining of a blur in the vision of the right eye. The following notes were made from his examination.

"The right eye has been observed at approximately yearly intervals since 1936, and since 1939 there has apparently been a very slow stretching of the sclera in the temporal area, as evidenced by some chorioretinal pigmentation in the temporal portion of the fundus. This was very slight until June, 1944, when a considerable amount of chorioretinal scarring was observed. The fundus temporally was seen with a minus 13.00 sphere lens, while the macular area was seen with a minus 1.00 sphere lens. It was felt that the stretching of the congenitally thin sclera in the left eye had been rather rapid prior to the detachment of the retina in the left eye in 1936. The sclera in the right eye had probably been stretching very slowly, giving the chorioretinal adhesions an opportunity to form and hold the retina in place. In the first week in April, 1945, the patient bumped the top of her head on a cabinet door. Visual symptoms began about the 17th or 18th of April as a small defect in the upper nasal field of the right eye. It became more noticeable, and in a few days she found that she was unable to read with the right eye. The examination on April 28th showed a large bullous detachment in the lower temporal quadrant; the vision was reduced to counting fingers at 2 feet.

External Examination, Right eye. Between the 8- and 10-o'clock positions, about 12 to 15 mm. from the limbus, the sclera was very thin and ectatic. This was greatest between the 9- and 11-o'clock positions. It extended back as far as one could see. The cornea was clear, the anterior chamber of normal depth, the iris pattern normal, and the pupil was round and reacted.

Left eye. Between the 2- and 4-o'clock positions, about 10 mm. from the limbus, there was a healed scar in the conjunctiva and sclera, the site of the

operation. At the lower end of this scar there was a small, ectatic, slightly bluish area due to the distortion of the scleral coat. This was essentially the same as it was in 1936.

Ophthalmoscopic Examination, Right eye. The nervehead was normal. The retina between the 12- and 5-o'clock positions was in place, and no particular degenerative change was noted. From the



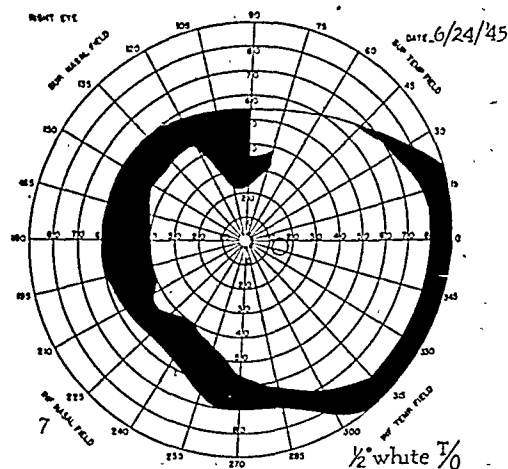
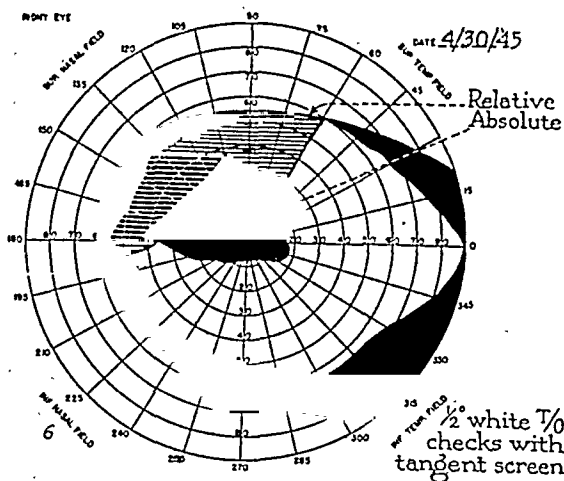
Fig. 5 (Vail). Fundus appearance three years after operation; left eye.

5- to the 10-o'clock position there was a detachment of the retina extending from the equator to the periphery. From the 5- to 6-o'clock positions, from the equator to the periphery, there was a slightly wrinkled, low detachment which joined a large bullous detachment. Above the upper temporal border of the bulla there was a flat detachment which extended to about the 11-o'clock position. At the 9:30-o'clock position, between the equator and the ora, there was a small area of blood in the retina. No definite hole or tear could be made out. Toward the periphery the elevation of the retina was less marked than at the equator. The macular

area was obscured by the bullous detachment (fig. 6).

Left eye. There were a few stringy vitreous opacities centrally located. The nervehead and blood vessels were normal. A slight irregularity of the surface of the retina was observed in the macular area. The retina everywhere was in place. There was a large scar in the equatorial region extending from the 2- to the 4-

Under local anesthesia (retrobulbar and Van Lint injections of novocaine) and superior rectus bridle suture, the conjunctiva and Tenon's capsule were incised over the area of the scleral staphyloma, which was discovered to be larger than suspected, measuring approximately 20 by 7 mm. and rising abruptly from the surface of the sclera. It was bluish in color and very thin, dimpling at the



Figs. 6, 7 (Vail). Field studies. Fig. 6, Preoperative field of vision; right eye. Fig. 7, Postoperative (6 weeks) field of vision; right eye.

o'clock position. The retinal vessels could be seen to stop abruptly at the chorioretinal scarring. Peripheral to the operative site there was considerable chorioretinal scarring, and the retinal vessels could not be seen. There was no other fundus lesion.

The patient was kept in bed, wearing pinhole glasses and using atropine in the right eye. On May 8, 1945 (V-E Day), operation on the right eye was performed (scleral resection) by me, assisted by Lt. Col. Elliott Randolph (MC.), and Capt. John McGavic (M.C.). I am greatly indebted to them for the opportunity and their skillful help during the operation, and for the careful notes and postoperative care of the patient by one of them (J. McG.).

slightest pressure. The external rectus was reflected. Three 7-0, black-silk sutures on atraumatic needles were firmly placed in the sclera on each side of the ectasia, in which a fixation suture had been placed. A part of the ectasia was then excised in the same way as described in the operation on the left eye, and the three silk sutures were tied. This left a buckled area in the sclera at the lower end of the incision. It was felt that reattachment of the retina was quite unlikely to take place if this folding of the remaining scleral ectasia was allowed to remain. Sutures were then placed in the sclera on each side of the fold, and the rest of the staphyloma resected. When the sutures were tied, the contour of the globe was quite good, and no buckling or fold-

ing remained. During the short time that the scleral wound was open, the vitreous appeared to be of good consistency. Surprisingly little vitreous was lost. The conjunctiva and Tenon's capsule were closed with interrupted black-silk sutures. A good reflex was present after the operation. Atropine and sulfathiazole ointment were applied, and a binocular Ring mask used.

The piece of excised sclera was thin and rather "brittle." Some blood and pigment were present on its inner surface, but no retinal elements were to be seen on microscopic examination of the tissue later.

Convalescence was uneventful. In 12 days the postoperative reaction, which was not great, had almost completely subsided. There was a good fundus reflex throughout. Some blood in the lower portion of the vitreous was seen, as well as choroidal and retinal hemorrhages at the lower end of the incision. The retina appeared to be in place. The field of vision was full (fingers). On the 24th of May, pigmentation along the lips of the scleral-incision area within the eye could be seen. The patient was discharged from the hospital on June 10 (fig. 7). On July 8, 1945, two months after the operation, the examination showed the retina to be in place everywhere. A small vitreous hemorrhage was still present. The retinal and choroidal hemorrhage had become absorbed, and pigmentation along the scar was well advanced (fig. 8, see Frontispiece).

The refraction in the right eye was found to have changed from $-0.50D.$ sph. $\approx -0.75D.$ cyl. ax. 175° with which the patient had $20/20+$ vision prior to the onset of the detachment, to $+1.25D.$ sph. $\approx +4.50D.$ cyl. ax. 175° , which gave her a vision of $20/30+1$. With $+2.50D.$ sph. added she read J1. The vision of the left eye on this date,

with $+3.50D.$ sph. $\approx +3.25D.$ cyl. ax. 25° was $20/40-1$; with a $+2.50D.$ sph. added she read J1 slowly.

This extraordinary case of double, scleral equatorial staphyloma and detached retina cured by scleral resection of the staphyloma gives us much food for thought. The origins of these lesions are mysterious, and they are usually monocular when they do occur. The underlying weakness of the sclera may very likely persist for a long time before the sclera more or less rapidly yields. The absence of all signs of glaucoma in this case rules out increased intraocular pressure as the exciting cause. It is logical to assume that some inherent weakness of the scleral coat existed, probably on a congenital basis, perhaps similar in its genesis to that encountered in keratoconus, affecting the temporal equatorial region of both eyes. The possibility that a cyst of the retina may be the cause of the scleral ectasia as the result of pressure is another thought. If this were so, it would explain the absence of retinal elements on the underlying surface of the excised specimen. Nor is there any answer to the question: Why was vitreous lost at all if the retina was intact? The more or less linear scar seen with the ophthalmoscope, particularly in the left eye, suggests a linear cut or tear in the retina at the time of operation. Other questions that need an answer are: Why was the temporal area affected in each eye? Is this the influence of the action of the superior oblique or other ocular muscles upon a weakened sclera? Nine years have elapsed since the first operation was performed and, as yet, no recurrence of the staphyloma has developed in spite of the continued normal action of the superior oblique and other ocular muscles. The temporal radial meridian of the eyeball is greater than the nasal in relation to the support given to the eyeball by

the optic nerve and the limbal area, and this may also be a factor. But further speculation is fruitless until we know more about the condition. However, I believe it would be a wise policy to excise these staphylomas before retinal detachment occurs in view of the fact that the technique of scleral resection lends itself very well to this condition.

OTHER CONDITIONS in which scleral resection could be considered (speculative only): 1. The removal of a melanoma of the choroid in an only eye. 2. An area of severe episcleritis, or inflammatory nodule, or malignant lesion in the sclera. 3. The excision of disintegrating areas or plaques in the sclera in scleromalacia perforans.

EXPERIMENTAL STUDIES

So far as could be determined the only laboratory experimental studies of scleral resection reported in the literature are contained in a paper by Wiener.¹⁷ He, however, was primarily interested in resecting strips of sclera longitudinally, thus lengthening the eyeball. He found that if one excises an elliptical segment of sclera 9 mm. long and 1.5 mm. wide from four opposite sides of the eye and brings the edges together by means of three sutures each, the eye will be length-

ened approximately 2.5 mm. to 3.0 mm. The refraction is changed from about normal to between 8 and 9 diopters minus. Wiener found that in lengthening the eye, the increase is 1.27 times the width of one of the segments removed. In shortening the eye, the decrease is 0.636 times the width of the segment removed, or about half as much as in the lengthening process.

SUMMARY AND CONCLUSIONS

The technique of scleral excision is described. It has been successfully performed by a number of ophthalmic surgeons in cases of retinal detachment, high myopia, and anterior and posterior scleral staphylomas. Enough operations on each of these conditions have been performed to indicate its value in selected instances. It is worthy of further study, particularly with a view to improvement in its technique and the development of special instruments to increase the facility of its function. There is a need, too, for experimental studies, particularly in laboratory animals. The question of scleral staphyloma needs further elucidation.

I am indebted to Lee Allen, artist, Department of Ophthalmology, University of Iowa Medical School, for the beautiful fundus painting.

55 East Washington Street (2)

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RETINAL HEMORRHAGE AS SEEN IN AN ATOMIC-BOMB CASUALTY

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The writer was recently stationed in Japan as Force Surgeon on the staff of Marine General Ray Robinson, the Commanding General of the Fukuoka Occupation Force. We were the first troops to arrive and assume occupation control of Northern Kyushu and Southern Honshu, Japan, early in September, 1945. Located in Fukuoka was the Kyushu Imperial University and its medical school, which hospitalized many atomic-bomb patients from both Hiroshima and Nagasaki.

Through the courtesy of Drs. Tamura and Ikui, who directed the Ophthalmic Institute of the Kyushu Imperial University, the illustrations for the case here-with reported were made available.

The patient was a Japanese girl, aged 14 years, showing retinal hemorrhages as a result of the atomic-bomb explosion at Nagasaki, Kyushu, Japan, on August 9th.

The salient fact was that this patient suffered from excessive gamma-ray ir-

radiations, which produced her clinical picture. She was first observed early in



Fig. 1 (Benkwith). The patient on October 10, 1945. Recent symptoms were petechiae in the skin, slight epilation, bleeding from the gums, and blurred vision.

September when an American-Japanese medical investigation team proceeded to Nagasaki to appraise the effects of the "bomb" on a cross section of the Nagasaki population. She was discovered to be ambulatory, although she had earlier suffered from malaise, headache, fever, nausea, and diarrhea. It was later (fig. 1) that she noted petechiae in her skin, slight epilation, bleeding from the gums, and blurred vision.

She was hospitalized for observation at the Ophthalmic Institute, Kyushu Imperial University at Fukuoka, where initial blood studies showed a leucopenia of 2,200 white blood corpuscles, prolonged bleeding time, decrease of platelets, and an anemia of 2.2 million red blood cells. She showed no evidence of blast wounds, cuts, or burns. She was approximately one mile from the accepted hypo-center of the atomic-bomb explosion, in her home, which was demolished at that time.

Examination of the fundi early in September showed a similar picture in each eye; that is, one of massive preretinal hemorrhages and hemorrhages into the fiber layer of the retina (fig. 2). These hemorrhages were distributed about the discs and in close association with the retinal vessels for approximately three disc diameters peripheral to the discs. In

the macula of the left eye was a large sausage-shaped hemorrhage appearing to be fed by the terminal arterioles and venules of that region. Small, fluffy, white exudates, were scattered about the disc and in close approximation to the retinal vessels of greater caliber.

During hospitalization the patient remained ambulatory and received little specific medication except iron, persimmon-leaf extract, plus the Japanese diet of rice, vegetables, and tea. The ill effects of the excessive radiant energy on this patient gradually subsided, so that by November there was a definite clearing of the fundi. The retinal hemorrhages were absorbed faster than the whitish areas of apparent serofibrinous exudate, which also disappeared. Very little evidence of pathologic change was visible in the fundi by December. However, in the fundus of the left eye a small white, although more discolored, area persisted. This is shown in the drawing to lie just inferior to the macular region. The vitreous was clear of floaters, and the vision returned to normal. The patient's general physical condition showed improvement which coincided with the improved ocular findings. She was pronounced well and recovered at the turn of the year.

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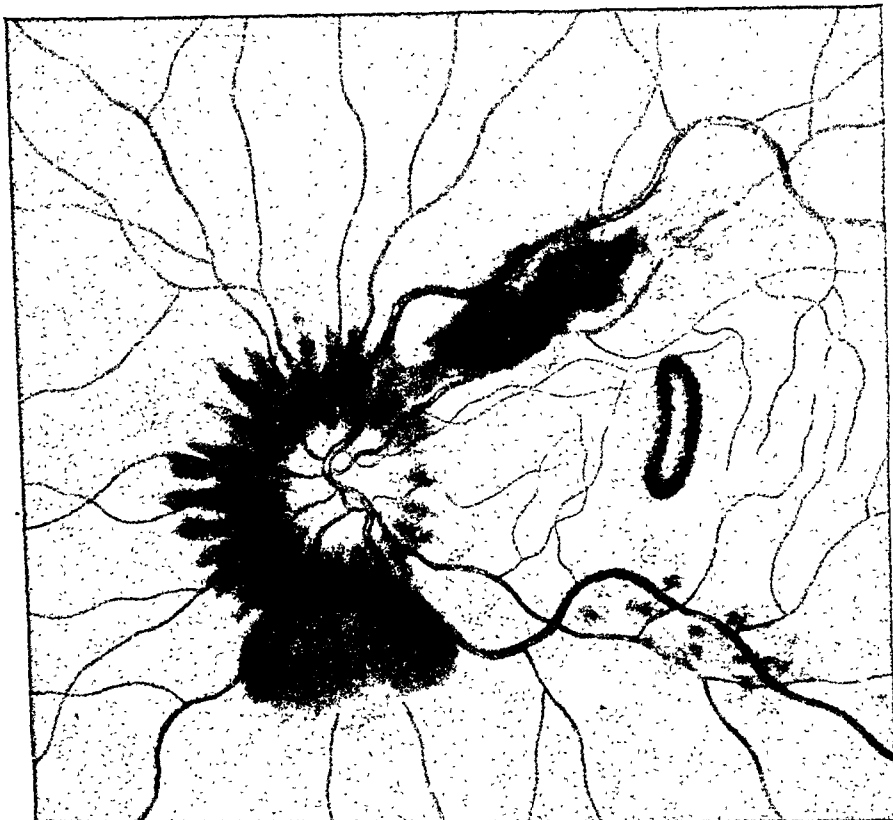


FIG. 2 (BENKWITH). FUNDUS OF THE LEFT EYE, SHOWING MASSIVE PRERETINAL HEMORRHAGES AND HEMORRHAGES INTO THE FIBER LAYER OF THE RETINA. A LARGE SAUSAGE-SHAPED HEMORRHAGE APPEARS TO BE FED BY THE TERMINAL ARTERIOLES AND VENULES OF THAT REGION. SMALL, FLUFFY, WHITE EXUDATES ARE SCATTERED ABOUT THE DISC AND IN CLOSE APPROXIMATION TO THE RETINAL VESSELS OF GREATER CALIBER.

SOME EFFECTS OF VITAMIN-A DEFICIENCY ON THE EYE OF THE RABBIT*

IDA MANN, A. PIRIE, K. TANSLEY, AND C. WOOD
WITH THE TECHNICAL ASSISTANCE OF M. BARNETT

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It is well known that nutritional or deficiency disease is responsible for widespread disorders of sight. The Report on Nutrition in the Colonial Empire (1939) states that "... diseases due to deficiency of vitamin A are perhaps the most common of all in the Colonial Empire. There are reports from a wide selection of territories of affections of the eye, nightblindness, xerophthalmia, keratomalacia . . . the prevalence of Bitot's spots and xerosis of the skin and hair are probably also due to insufficiency of vitamin A." This report has been supported by D. F. Moore (1940), who states that in the Philippines half the children attending hospitals had xerophthalmia, that in the Dutch East Indies, 4,000 children in half a million were blind, and that this high incidence is attributed to xerophthalmia.

Although much work has been done on the subject since the discovery of accessory food factors by Hopkins (1912), there are still certain gaps in our knowledge of the effects of vitamin-A deficiency on the eye. It is well known that the most striking general change in both man and experimental animals is a metaplasia of the surface cells of epithelia in the direction of the squamous and keratinized type. The epithelial metaplasia is always in the direction of simplification to a less highly specialized type; for example, mucous membranes lose their mucous cells and become uniform and keratinized. This change tends not to involve the basal cells, so that regeneration is usually possible and rapid. The surface involvement is

widespread, affecting both ectodermal and endodermal epithelia so that many remote and superficially unrelated clinical effects are produced; for example, effects on the eyes, the skin, the lungs, the vagina, many glandular organs, and the central nervous system.

In addition to the fundamental epithelial change, various observers have described effects on the growth of blood vessels (for example vascularization of the cornea, Wolbach and Howe, 1925), effects on the resistance to infection of various organs, pigmentary and bony changes, and changes in nerve fibers. The papers reporting these changes have recently been summarized by Bicknell and Prescott (1942) and by Wolbach and Bessey (1942).

Although the main effects on the eye (nightblindness and xerophthalmia) are known with certainty, there still remain many details that are obscure. In the first place, we are not certain how much of the eye change is primary and directly due to the deficiency and the resulting epithelial change, and how much is secondary, due either to infection or to changes in the lacrimal glands, in bone, or in the nervous system. We do not know precisely the time relationship between the various clinical signs, nor the relation between the level of vitamin A in the blood and the histologic appearances of the eyes. Neither do we know the early biomicroscopic appearances, nor their relation to the histology.

We have, therefore, made a study of the condition in rabbits and have drawn certain conclusions about to be discussed for this species. It must be fully under-

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stood, however, that a direct argument from rabbits to man is inadmissible in detail for three reasons: (1) The physiologic requirements of rabbits are not identical with those of man, so that the same sequence of similar clinical signs may not hold good for both. (2) Since the conjunctiva of rabbits is not normally exposed to the air, changes characterized by dryness in man may be somewhat different in appearance in rabbits. (3) Since alterations in retinal function cannot at present be detected in rabbits, structural retinal change alone has been considered in this paper, and no conclusions as to nightblindness can be drawn.

Before proceeding to a detailed description of the experiment and the findings, it is advisable to state briefly the conclusions we have arrived at for rabbits. These all confirm Wolbach and Howe's (1925) that the primary action is on epithelium:

1. The primary effect of vitamin-A deficiency on the eye is an epithelial change. This appears first on the cornea and can be detected here with a slitlamp, one to three months before it is visible with the naked eye, and often two to three weeks before it can be diagnosed with certainty by means of a loupe.
2. A pigmentary change in the conjunctiva (of pigmented rabbits) appears simultaneously with, or slightly after, the corneal change and can first be seen with the slitlamp.
3. A surface conjunctival change can be detected with the slitlamp some time later than the pigmentary change.
4. Any changes that there may be in the lacrimal gland are not the cause of the corneal change, which appears first.
5. The substantia propria, the corneal endothelium, and the corneal nerve fibers are not abnormal to slitlamp examination; neither were retinal changes observed with the ophthalmoscope or histologically.
6. Corneal vascularization and infiltration do not occur as part of the deficiency syndrome.
7. Signs of deficiency were usually established with no signs of concomitant infection. In a few cases apparent infection developed later than deficiency signs. This may account for vascularization of the cornea in the rare cases in which this occurs. No bacteriologic examinations were made.
8. The younger the rabbit at the beginning of

the experiment the shorter the time required to produce changes in the eyes.

9. Correlation between plasma vitamin-A levels and time of onset of eye changes shows that the blood level sinks to about 10 percent of the normal before any eye change can be detected.
10. The eye changes described, apart from those produced by gross secondary infection, can be reversed by treatment with vitamin-A, the corneal change disappearing first, before the plasma vitamin-A is normal, and the pigmentation of the conjunctiva last.

EXPERIMENTAL METHODS

Rabbits were used, since they are easily rendered deficient in vitamin A and are docile under repeated slitlamp and other examinations. In addition, they present a larger area of conjunctiva for observation than do rats or guinea pigs and also frequently show limbal pigment rings similar to those seen in Africans and some other pigmented races. Their intraocular structure (for example, depth of anterior chamber) is more similar to that of man than is that of most other convenient laboratory animals.

Sixty rabbits of mixed laboratory stock were used. Fifty were rendered vitamin-A deficient and 10 were litter-mate controls. The rabbits were chosen mainly for eye color. Most were from a crossed Dutch strain with blue or heterochromic irides and a limbal pigment ring. As will be seen later, the stock was not entirely free from congenital abnormalities, one rabbit having a coloboma of the nerve sheath and others showing minor retinal abnormalities. Otherwise the animals were all healthy.

The deficiency was induced in two age groups. The first was composed of healthy weaned rabbits put on a vitamin-A-deficient diet when aged five to seven weeks. There were eight of these. Those in the second group were younger, their nursing does being put on an A-deficient diet as soon after the birth as possible. This diet was continued to the young afterwards, which could, therefore, be

said to have received an A-deficient diet from three to four weeks of age.

DIET

A diet of crushed oats plus 1.5-percent powdered chalk mixed and made just damp with water was fed *ad libitum*. In addition, water was freely available, and 5 mg. ascorbic acid, mixed in a spoonful of bran for convenience of measurement, was given to each rabbit each day.

Percentage analysis of crushed oats (Bull. No. 48, Ministry of Agric. & Fish.)

Protein	Oil	Carbohydrate	CaO	P ₂ O ₅
10.3	4.8	58.2	0.14	0.81

B complex g/100 gm. wet crushed oats (Burkholder, 1943)

B ₁	B ₂	Nicotinic Acid	Biotin	Pantothenic Acid	Pyridoxin	Folic Acid
113	8	75	9	75	3	220

The chalk was added to bring the calcium/phosphorus ratio of the oats near unity in order to diminish the need for vitamin D. Rickets has not been reported in rabbits, and in general no vitamin D was given to the experimental animals;

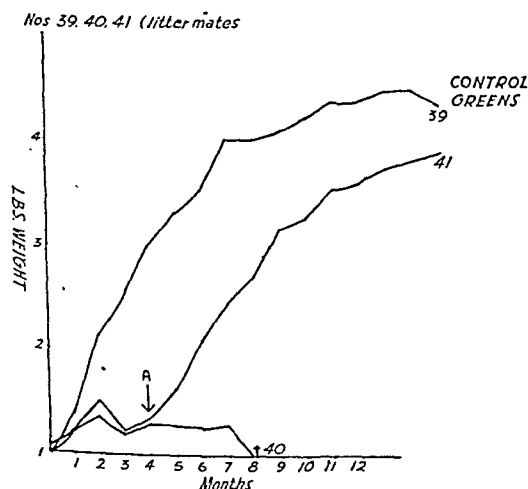


Chart 1 (Mann *et al.*). Growth curves of three litter mates. No. 39 was fed greens throughout. No. 40 died after eight months on the deficient diet. No. 41 was dosed with vitamin-A concentrate after four months' deficiency.

but some of the young rabbits put on the diet at the age of three weeks were given one or two weekly doses of 200 I.U. irradiated ergosterol. They showed no difference in growth rate nor in the development of vitamin-A deficiency. The grown rabbits ate about 75 gm. (dry) of the diet per day. Controls were given the same food with about two ounces of greens, or a daily dose of about 500 I.U. of vitamin A by mouth. The "A Controls" grew at about the same rate as those receiving greens, reached a normal body weight, and appeared healthy in every way. Attempts to improve the growth rate of rabbits given vitamin A during cure of the

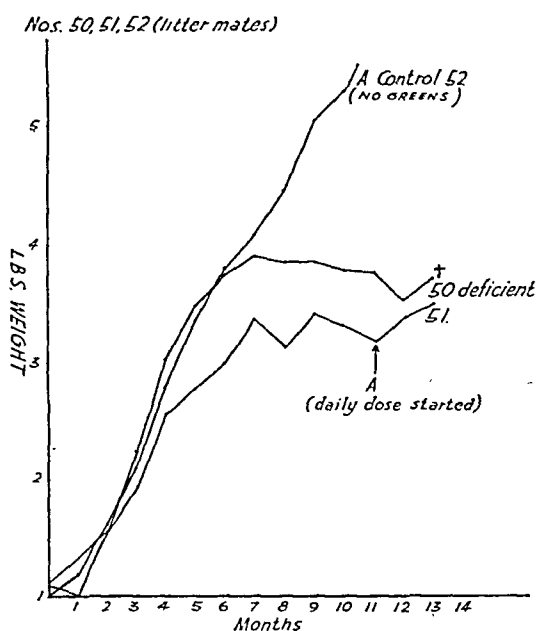


Chart 2 (Mann *et al.*). Growth curves of three litter mates. All were given one dose of about 1,000 I.U. of vitamin A at start of experiment (three weeks old). No. 52 was given vitamin-A concentrate throughout life. No. 50 was on deficient diet for 14 months, and No. 51 was cured with vitamin-A concentrate after 11 months' deficiency.

deficiency by addition of 5-percent casein, or 5-percent dried brewers' yeast to the diet made no noticeable difference. The rabbits were weighed once a week. Charts 1 and 2 show the growth curves of two litters, each having control and experimental animals.

Vitamin A was given by mouth either as Prepalin (Glaxo) or as a solution of vitamin A in arachis oil. The dose was approximately 500-1,000 I.U. per day per rabbit. A large dose was purposely chosen to get rapid cure.

ESTIMATION OF VITAMIN A IN THE BLOOD

Blood was taken before the morning feed from the marginal ear vein into citrated tubes. Three to 5 ml. of plasma was stored in ice overnight and then the carotene and vitamin-A content were estimated by the following method, a modification of that described by Yudkin (1941): 2.0 ml. of the plasma was pipetted into a 15-ml. test tube and 2.0 ml. 95-percent ethyl alcohol added drop by drop, the tube being well shaken after each addition; 4 ml. of petrol ether (B.P. 40° to 60°) was then added, and the tube was well corked and shaken by hand for 10 minutes. The layers were allowed to separate, and 2.0 ml. of the petrol-ether layer was transferred to a colorimeter tube; 0.25 ml. of petrol ether was added, and the carotene measured in a photoelectric colorimeter with a 440-millimicron filter. After the petrol ether had been evaporated off on a waterbath at 55° to 60° and then for a few seconds at 70°, the residue was dissolved in 0.2 ml. of anhydrous chloroform, one drop of acetic anhydride was added, and the tube placed in the colorimeter with the light intensity already adjusted (620 millimicron filter). Then 2.0 ml. of Carr-Price reagent was added to the tube in position from an automatic pipette and the maximum temporarily steady galvanometer de-

flection recorded. The tube was removed at once and the result discarded if the solution was turbid. Galvanometer readings were converted to I.U. carotene and vitamin A per 100 ml. plasma by reference to calibration curves.

The rabbits were inspected frequently, and at least once a week were investigated thoroughly with a slitlamp. As soon as the signs of deficiency had reached the desired stage, one eye of the rabbit was removed (under intravenous nembutal anesthesia) for sectioning. Portions of the conjunctiva, lids, and lacrimal and Harderian glands were taken at the same time. The animal was then treated with vitamin A, and the progress toward cure was observed in the remaining eye. When improvement appeared maximal, the rabbit was killed, and the tissues of the second eye were sectioned.

CLINICAL COURSE OF THE DEFICIENCY

The *first sign* of any effect from the deficient diet was a failure to gain weight at the same rate as the litter-mate control. The second sign was the appearance of a change in the corneal epithelium detectable only with the slitlamp. The lag in weight appeared earlier and was more marked the younger the rabbit at the beginning of the experiment, a fact noticed also by Mellanby (1944), and, similarly, the corneal change appeared earlier in the younger rabbits. At its earliest appearance, this corneal change could best be described as a very superficial epithelial disturbance. A few of the surface cells in the central area of the cornea looked opaque and slightly greasy. Microscopic examination later verified that these were epithelial cells undergoing metaplasia into squamous and keratinized cells. At first only a few cells here and there were affected, but soon they spread uniformly over the whole central area, which then became opaque, but did not in most cases

reach the limbus. There was no green staining with fluorescein, showing that there was no loss of surface. Of the area of metaplasia only the central part stained faintly pink with eosin, indicating that the cells were keratinizing. Picric acid did not stain.

At first the substantia propria could be seen easily through the altered epithelium. It showed no change. Mouriquand, Rollet, and Chaix (1931) made slitlamp observations in A-deficient albino rats and found vascularization, interstitial infiltration, and edema of the substantia propria. Such changes did not appear in our experimental animals, even after long periods on the deficient diet. The nerve fibers were especially observed in some rabbits and did not change in appearance, number, or distribution during the experiment. Sauer (1939) made a histologic study of corneal nerve fibers in A-deficient rats and found that the nerves grow into the metaplasizing corneal epithelium. He concluded that degeneration of the nerve fibers could not be a primary cause of the epithelial change.

Later, the epithelial cells in the central area became white and greasy, or foamy, in appearance and heaped up into a dense plaque, often showing vacuolization. This plaque might disintegrate and be shed, showing for a few days a smooth, clear cornea. A heaped-up plaque would then be formed again. There was no cellular infiltration into the substantia propria.

The squamous change could be seen with the slitlamp to extend beyond the central area, where it was visible to the naked eye. In some cases it extended to the limbus, although the white heaped-up opacity scarcely ever did.

In some cases the movements of the third lid across the eye produced patterns like wave marks on sand in the loose keratinized layer. In no case did an ulcer develop. Plate 3 shows a normal rabbit eye

and a typical example of fairly severe deficiency.

The *second detectable eye change* was an outward migration of the chromatophores of the limbal pigment ring. This appeared simultaneously with, or slightly after, the corneal change. It led to the apparent widening and thinning of the pigment ring and finally to a smoky discoloration of the whole bulbar conjunctiva. It was readily seen with the naked eye and appeared comparable with the discoloration described by Treacher Collins (1930) as occurring in the pigmented races in man and in vitamin-A deficient animals. That it was due to migration of preëxisting chromatophores and not to a new development is certain, since only those animals with a pigment ring showed it. In a few of the rabbits one eye had a pigment ring and the other not. In these cases only the pigmented eye became "smoky." In one rabbit there was a gap in the pigment ring at the start, and during the experiment the chromatophores were watched, as they migrated first outward and then laterally from the ends of the gap, so that it finally almost disappeared, becoming nearly uniform with the general smokiness. In one instance only was any migration inward on to the cornea observed. This rabbit, which showed very severe changes in the corneal epithelium, extending right up to the limbus all round, also had a thick conjunctival discharge and may have been infected. The pigment migration on to the cornea had the appearance of an epithelial slide, such as occurs after injury, rather than a diffuse migration, and was not typical of A deficiency.

The *third eye change* to appear was an alteration (keratinization) of the conjunctiva, especially in the lower fornix. That this change, which antedates the corneal change in man, should be the last to show in rabbits is probably due to the

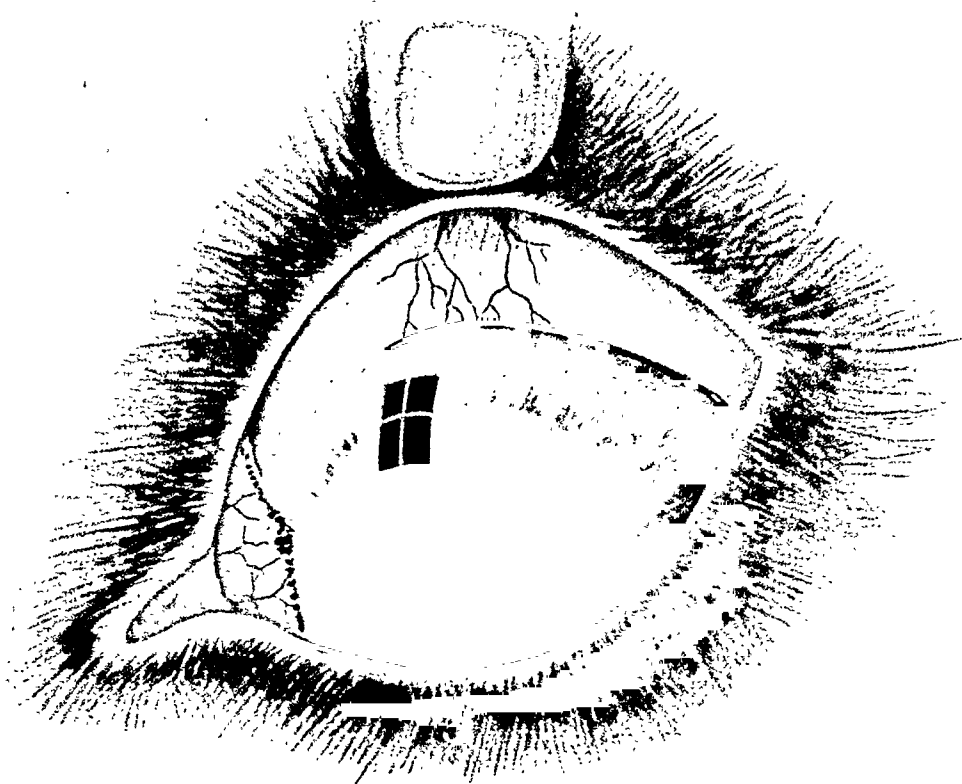
fact that practically no part of the rabbit's conjunctiva is normally exposed to the air. It appeared in rabbits a fortnight to three months after the first detectable corneal change and varied a good deal in intensity.

The white, greasy-looking surface accumulations in rubbing off the cornea and conjunctiva might appear as a thick white discharge. This was by no means always suggestive of infection; unfortunately, no bacteriologic tests could be made to clinch this point, but clinically the presence of coincident signs of inflammation—such as, redness of conjunctiva, swelling, eversion or ulceration of the lids—was taken as evidence of infection and not the presence of a foamy or greasy-white discharge alone. Thus, of six rabbits, four developed a severe ulcerative blepharoconjunctivitis with eversion and crusting of the lid margins. They were all in contact, and the condition occurred within 10 days in them all. In one of them, a slight vascularization at the margin of the cornea took place at the height of the inflammation. A fifth rabbit of this presumed-infected group had slight blepharitis and marginal vascularization, which cleared up during the cure of the A deficiency. Another rabbit also showed during the cure a similar but less-marked inflammation with marginal vascularization. Both inflammation and vessels disappeared rapidly under treatment with penicillin. In most of the rabbits we found no signs of inflammation and have no evidence, therefore, that, infection apart, corneal vascularization, infiltration, or ulceration, or conjunctival congestion is a necessary expression of A deficiency. Johnson (1943) found that treatment of

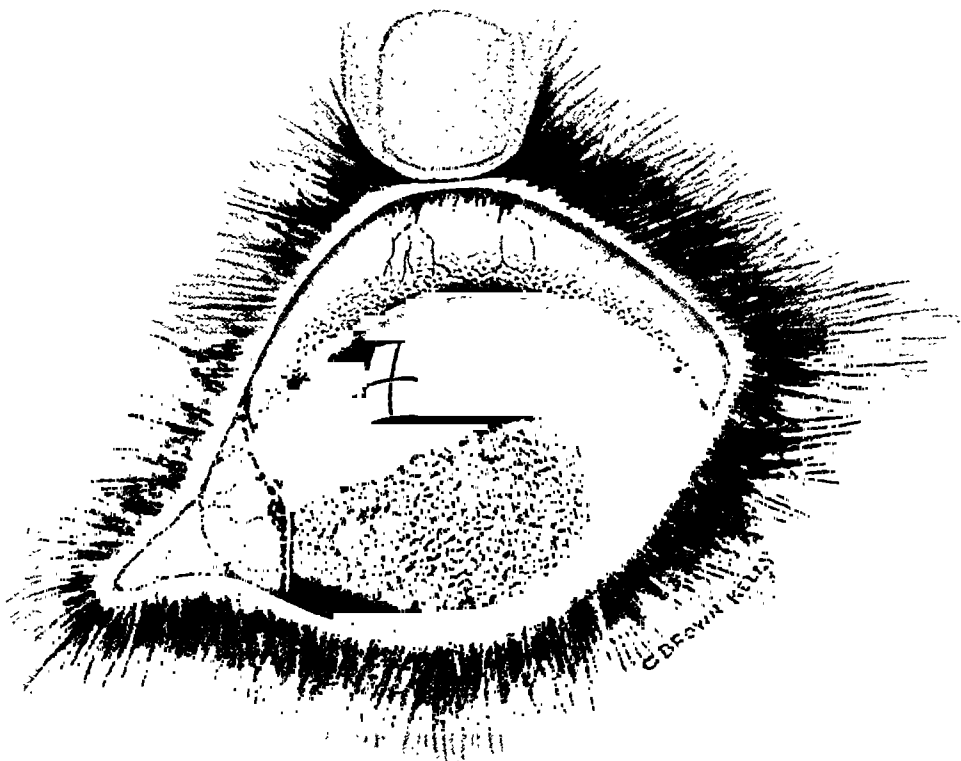
the eyes with liquid petrolatum and metaphen ophthalmic ointment prevented corneal ulcers in rats with severe xerophthalmia. The effect is probably partly mechanical, the eye being kept lubricated by the ointment, and partly anti-infective.

All the conjunctival changes due directly to the A deficiency were of the same nature as those in the cornea. The occurrence of Bitot's spots (white areas of keratinization) in A-deficient rabbits has been reported by Hetler (1934), and recently Kruse (1941) has suggested that thickening and wrinkling of the conjunctiva may be an early sign in man. He states, however, that this change takes many months of treatment with massive doses of vitamin A to clear up, and, from his description, it is not certain whether a thickening of the surface epithelium or of the subconjunctival tissues is meant. The changes in our rabbits were purely epithelial and cleared up rapidly under treatment.

In some of the rabbits, general changes occurred which were of interest, but which were not especially studied. In some cases these appeared before the eye signs, and no definite time correlation could be obtained between them. The rabbits commonly looked ill and seemed listless, with poor appetites. In some, the head was held tilted, and the rabbit tended to move in circles; in three others, affections of the hind legs, paresis, and attacks of deforming arthritis occurred. A similar arthritis also occurred in one control rabbit receiving vitamin A, and in one stock rabbit in the colony. No pathologic evidence of the exact nature of these was obtained, although the nerves of the leg muscles of two of the A-deficient rabbits showed, on



A



B

sectioning, no sign of present or past degeneration. We wish to thank Prof. J. Z. Young for preparing and reporting on these. One rabbit developed noisy breathing and several developed diarrhea.

Table 1 shows the relation between

there was an apparent worsening of the corneal condition, due to heaping up of the keratinized epithelium by the regenerating basal cells. This initial apparent worsening is very striking and was noticed by May and Wolff (1938) in a

TABLE 1
RELATION BETWEEN AGE OF RABBIT AND TIME OF APPEARANCE OF OCULAR
SIGNS OF VITAMIN-A DEFICIENCY

Rabbit No.	Age at Beginning of Deficient Diet	Time on Diet at which Corneal Change Visible with Slitlamp	Time on Diet at which Pigment Migration Visible with Slitlamp	Time on Diet at which Conjunctival Change Visible with Slitlamp	Total Time on Diet
	weeks	months	months	months	months
1	7	$7\frac{1}{2}$	$7\frac{3}{4}$	none	8
2	7	$7\frac{1}{2}$	$7\frac{3}{4}$	8, slight	11
3	7	$7\frac{1}{2}$	$8\frac{1}{4}$	—	10
6	7	4	4	7	14
7	7	4	4	$4\frac{1}{2}$	$4\frac{3}{4}$
8	7	4	4	7	7
11	5	3	5	—	7
12	5	4	5	—	7
19	4	2	2	—	3
20	4	2	2	5	6
21	4	$1\frac{1}{2}$	$2\frac{1}{2}$	4	6
22	4	2	$2\frac{1}{2}$	—	2
23	4	2	3	—	6
54	4	2	not pigmented	?infected	5
55	4	$1\frac{1}{2}$	2	—	4
56	4	$3\frac{1}{4}$	not pigmented	none	$4\frac{1}{2}$
57	4	none	slight, $3\frac{1}{2}$	none	$4\frac{1}{2}$
15	3	2	not pigmented	none	2
16	3	2	$1\frac{3}{4}$ -2	none	5
18	3	2	2	none	$4\frac{1}{2}$
25	3	$2\frac{3}{4}$	3	$3\frac{1}{2}$	7
26	3	$1\frac{3}{4}$	$2\frac{1}{2}$	3	3
27	3	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{2}$
28	3	$1\frac{1}{4}$	$1\frac{1}{4}$	—	$1\frac{3}{4}$
31	3	$2\frac{1}{4}$	$2\frac{1}{4}$	none	$2\frac{1}{4}$
37	3	$1\frac{1}{2}$	$2\frac{1}{2}$	—	$2\frac{1}{2}$
38	3	$2\frac{3}{4}$	$2\frac{1}{4}$	—	5
40	3	$2\frac{3}{4}$	not pigmented	3	7
43	3	$1\frac{1}{2}$	?	?infected	2
45	3	1	?	?infected	$2\frac{3}{4}$
48	3	$\frac{3}{4}$	?	?infected	$1\frac{3}{4}$
49	3	$1\frac{1}{4}$	?	?infected	$1\frac{1}{2}$

age of rabbit, time on deficient diet, and time of appearance of corneal, pigmentary, and conjunctival changes. General changes are not included.

CLINICAL COURSE OF THE CURE

This was much more rapid than that of the development of the deficiency. During the first few days of treatment

baby of seven months during treatment with cod-liver oil. In most cases, an improvement in the corneal condition was apparent in four days. The squamous cells were shed and did not reappear, and the cornea rapidly returned to normal. Often, large sheets of cast-off surface cells could be seen lying in the lower fornix and disintegrating into a thick, white discharge.

In some cases, the corneas were quite normal within a week of the administration of vitamin A; in others, slight changes could be detected for six weeks; the maximum improvement occurred early in all. As the cornea improved, the conjunctival discharge increased as all the surface cells were shed. In some cases the lining of the meibomian ducts was shed also and could be seen being extruded from their orifices. The pigmentation of the conjunctiva was the last macroscopic change to clear up. This occurred very slowly and seemed to be produced by disappearance of the migrated chromatophores and multiplication of the cells in the original pigment ring. In most cases it was not complete for three or four months, and in one, not for 15 months. It is, however, certain that if the animal is kept alive long enough all the abnormal pigmentation does eventually disappear, the eye becoming absolutely normal in every way.

The general condition also improved rapidly. The animal became lively, and the appetite improved. Structural joint change did not, however, recover, nor did the rabbits complete their growth, if this had been arrested. The rabbits which had received the deficient diet from three to four weeks weighed 3 to 4 pounds only, after prolonged administration of vitamin A. Whether this failure to reach normal size means that the diet was lacking in other factors or that the early arrest of growth permanently affected the skeletal and other structures we cannot be sure. It is, however, certain that the eye changes described are solely due to vitamin-A deficiency, since they were completely reversed by its administration.

HISTOLOGIC METHODS AND FINDINGS METHODS

The eyes, lids, and glands were fixed in Zenker's solution. In order to fix the retina quickly, the eyes were immediately

injected with the fixative down the optic nerve before being immersed in it. Pieces of bulbar conjunctiva, including the ring of pigmented cells round the limbus, were removed and stretched out on a slide and fixed in 10-percent formalin in H_2O . They were flattened between two slides during fixation.

All the material was blocked in paraffin wax. Sections of the cornea were cut tangentially, as advocated by Pullinger (1943). Sections of the conjunctiva were cut transversely to show thickening and keratinization of the epithelium, while unstained flat preparations, to show pigment scattering, were also made by dehydrating, clearing, and mounting the strip of conjunctiva on the slide on which it was originally fixed. For the retinal preparations, parts of the back of the eyeball, including the visual streak (Davis, 1929) of the retina, were cut transversely at 10μ .

Weigert's hematoxylin with eosin or van Gieson's stain was used. Some conjunctival sections were also stained with mucicarmine, others with a safranin picroindigo-carmine stain for keratin, but results with hematoxylin and eosin were more detailed. The retinal sections were stained with hematoxylin and eosin by Feulgen's method and by a modification of the azan method in which the azo-carmine is replaced by carmalum, as used in Wilder's silver method. For this modification the sections were mordanted in 1-percent phosphomolybic instead of phosphotungstic acid.

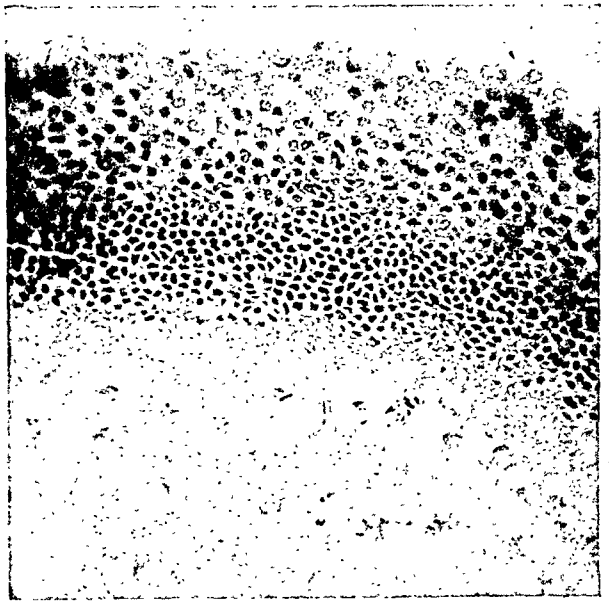
MICROSCOPIC FINDINGS

Cornea. No histologic change was detectable for about a month after a change was easily visible with the slitlamp. The first detectable histologic change paralleled the appearance of a continuous central area of opaque epithelium.

There is general agreement as to the histologic appearance of the vitamin-A-

deficient cornea, but there has been some argument as to which of the changes observed may be regarded as primarily due to the deficiency

Fig. 1 (Mann *et al.*). Healthy cornea. Tangential section through surface layers of cornea of left eye of Rabbit 15 after 7 days on vitamin A. Staining: Zenker, Hematoxylin and eosin.



and which are merely secondary. All observers (Mori, 1922b; Yudkin and Lambert, 1921; Wolbach and Howe, 1925; Mellanby, 1934; Hetler, 1934) agree that the surface layers of the corneal epithelium become keratinized in all species of laboratory animal examined, including the rabbit, but while Wolbach and Howe believed this to be the primary change, Yudkin and Lambert as well as Mori were of the opinion that the corneal changes are secondary to infection (Yudkin and Lambert) or changes in the lacrimal glands (Mori). These workers were impressed by the fact that changes could be recognized in the conjunctiva while the cornea was still apparently unaffected.

Mori found infiltration and vascularization of the cornea in rats and sometimes

ulceration and perforation. Wolbach and Howe, on the other hand, never found corneal ulceration in rats, although vascularization was common, whereas Hetler reported ulceration of the cornea in a monkey as well as in one eye of a deficient rabbit. In addition, she examined the eyes of deficient rats and guinea pigs, but only mentions corneal vascularization in the monkey.

In our rabbits, the surface layer of the corneal epithelium was always keratinized, but there was little alteration either

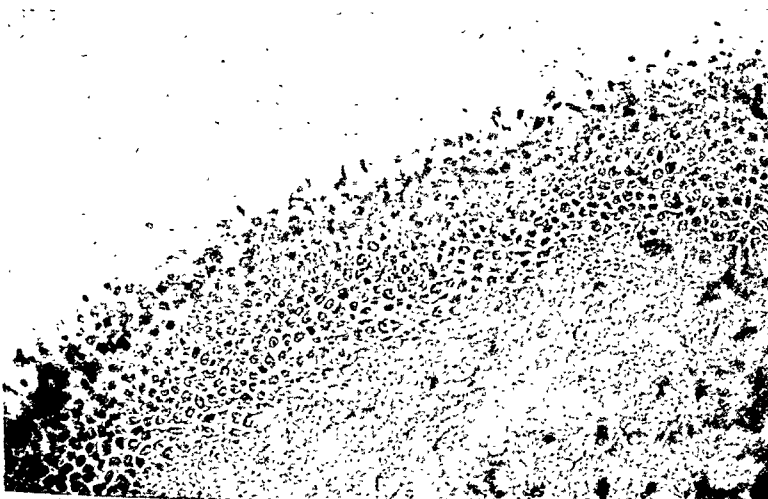


Fig. 2 (Mann *et al.*). Mildly deficient cornea of rabbit. Tangential section through cornea of right eye of Rabbit 15 after two months on deficient diet. The outer epithelial cells are unhealthy and in the process of being shed but are not yet keratinized. Compare figure 1 (left eye of same animal after cure). Staining: Zenker, Hematoxylin and eosin.

in the basal layers of the epithelium or in the substantia propria (figs. 2, 3). The number of dividing cells in the basal epithelial layers was slightly increased over the normal amount (cf. Wolbach and Howe, 1925, fig. 3) and there were possibly rather more pyknotic nuclei in the substantia propria. Infiltration was not common; we found polymorphonuclear cells in one animal and a little round-

Lambert (1921) and by Wolbach and Howe (1925). In this animal the deficiency leads to general atrophy of the alveoli and keratinization of the ducts of the gland; in the rabbit we were unable to demonstrate any change at all.

Lacrimal gland. Mori (1922a) described changes in the lacrimal glands of vitamin-A-deficient rats which he re-



Fig. 3 (Mann *et al.*). Severely deficient cornea. Tangential section through surface layers of cornea of Rabbit 6 after 14 months on the deficient diet. The surface is keratinized. Note also mitoses in basal layer of corneal epithelium. Staining: Zenker, Hematoxylin and eosin.

cell infiltration in one or two other corneas.

Lids. Focal lesions with infiltration have been described by Yudkin and Lambert (1921) as an early change in vitamin-A deficiency of the rat, while Mori (1922a) found change in the meibomian glands of this animal, which, however, Wolbach and Howe (1925) declared to be insignificant. In rabbits we found some keratinization of the lining epithelium of the lids, but no other change; the meibomian glands appeared normal.

Harderian gland. The effect of vitamin-A deficiency on the harderian gland of the rat has been studied by Yudkin and

garded as being the most important of all. He believed that, by putting an end to lacrimation, the lacrimal-gland changes were responsible for all the other ocular effects. Yudkin and Lambert (1921) confirmed Mori's findings but stated that the changes described by him may be seen in normal rats. Their paper gives the impression that they did not find the lacrimal gland much affected in the rat. Wolbach and Howe (1925) found atrophy of the tubules and keratinization of the ducts in the glands of A-deficient rats.

We found much the same changes as those described by Mori, Yudkin and Lambert, and Wolbach and Howe in our rabbits. The most marked of these was a loss of granular material from many of

the secreting cells, so that their cytoplasm appeared much less dense than normal. These cells were also swollen, so that the central lumen of the tubules affected tended to be obliterated. The nuclei often appeared normal but they were sometimes pyknotic or even missing altogether. Only some tubules of any given gland were affected, and the proportion remaining normal seemed to bear little relationship to the severity of the deficiency.

epithelium. Mori (1922b) reports the finding of keratohyaline granules in the deficient conjunctiva of the rat (but not in the cornea), and Hetler (1934) in the monkey and in one rabbit eye; she does not mention their presence in any of her deficient rats but says specifically that they were not produced in the guinea pig, Yudkin and Lambert (1921) noticed focal infiltration in the conjunctivas of rats during the early stages of deficiency and,

Fig. 4 (Mann *et al.*). Healthy conjunctiva. Transverse section through lower conjunctiva from left eye of Rabbit 38 after seven days on vitamin A. Staining: Zenker, Hematoxylin and eosin.

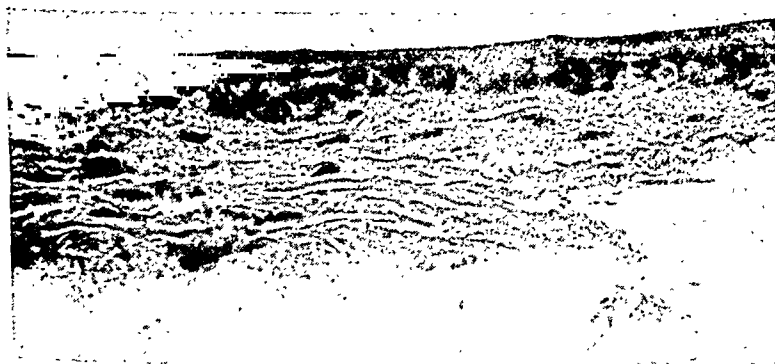
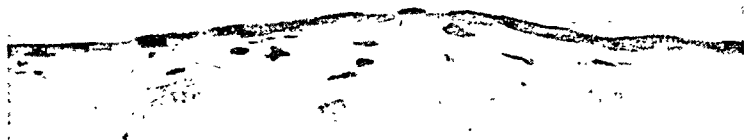


Fig. 5 (Mann *et al.*). Deficient conjunctiva. Transverse section through lower conjunctiva from right eye of Rabbit 38 after 2 $\frac{3}{4}$ months on deficient diet. The conjunctiva is much thickened and its surface keratinized. Compare figure 4 (left eye of the same animal after cure). Staining: Zenker, Hematoxylin and eosin.

The end result, even after treatment with vitamin A, was atrophy and fibrosis, although there was always a considerable number of normal tubules left. We confirmed Mori's observation that there are areas in which the tissue appears to be a simple mass of nuclei, but like Yudkin and Lambert, found the same phenomenon in the cured and control specimens.

Conjunctiva. It is generally agreed that vitamin-A deficiency leads to thickening and keratinization of the conjunctival

therefore, concluded that the corneal changes were secondary to infection of the conjunctiva. Treacher Collins (1930) refers to a case in which the conjunctiva of a man suffering from vitamin-A deficiency had no mucous cells.

We found keratinization and great thickening of the conjunctival epithelium with pigment in the cells of the basal layers (figs. 4 and 5). The stroma seemed fairly normal, although not entirely healthy, and there were some pyknotic nuclei. There was slight round-cell infiltration of the stroma in some, but by

no means all of the preparations. No mucous cells could be found in the deficient conjunctivas.

The retina. No changes in the appearance of the fundus have been reported in rabbits as a result of vitamin-A deficiency, and none were seen in these experiments.

Characteristic changes in the structure and staining reactions of the retinas of rats and dogs suffering from vitamin-A deficiency were first reported by Tansley

limbs becomes thin, and the retina tends to break at this point, leaving the outer limbs in contact with the pigment epithelium. Later still, the rods become ragged and unhealthy looking and are separated from each other and the pigment epithelium by large vacuolelike spaces. Johnson describes an even later stage in which the whole outer part of the retina disappears, but this was not seen either by Tansley or by Anderson and Hart.

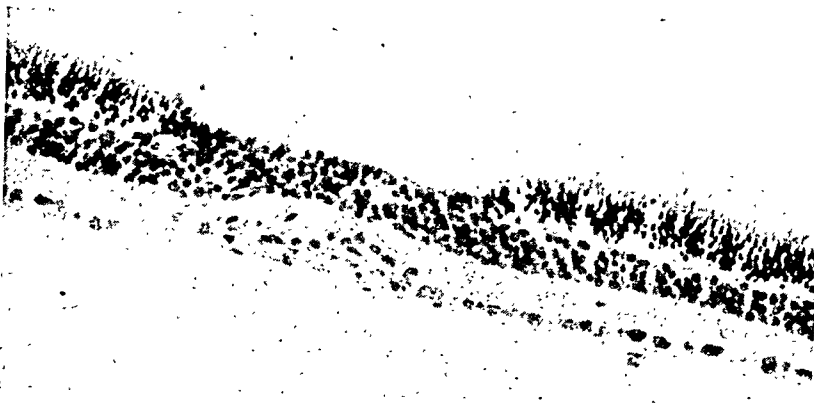


Fig. 6 (Mann *et al.*). Retinal degeneration. Transverse section through retina of right eye of Rabbit 7, showing small area where the rods and cones together with most of their nuclei have disappeared. The surrounding retina is normal. Staining: Zenker, Hematoxylin and eosin.

(1933, 1936) and later confirmed in rats by Johnson (1939, 1943). Similar changes have recently been described by Anderson and Hart (1943) in the retina of the vitamin-A-deficient horse.

The first effect of this deficiency on the rat retina is a loss of differential staining of the inner and outer limbs of the rods with certain histologic stains. In the normal retina, Mallory's triple stain for connective tissues and its modifications, of which the modified azan technique already described is one, colors the outer limbs yellow and the inner limbs blue; whereas with Feulgen's method the outer limbs become purple and the inner green. In the deficient animal, the outer limb loses its characteristic staining reaction and is much less readily distinguishable from the rest of the rod. At a later stage the junction between inner and outer

The rabbits in these experiments showed no retinal changes that could confidently be attributed to vitamin-A deficiency. In some of the retinas the differential staining of the outer limbs of the rods was rather poor, and in some there was a tendency to split between the inner and outer limbs, particularly in the central areas, but in no case was there any evidence of degeneration in any part of the rod outside the nucleus. Four animals (A7, A8, A9, and A19) had a number of degenerate *nuclei* in their retinas, both among the rod nuclei (outer nuclear layer) and the bipolar cells (inner nuclear layer), but these degenerations were confined to rather small areas in the central retina, and, although in some eyes they were associated with the breaking up of the rods, this was not necessarily the case. In A7 there was a relatively small

area where the whole retina outside the inner nuclear layer had disappeared completely, but the greater part of the retina was perfectly healthy (fig. 6). A8 had a coloboma of the optic-nerve sheath, a recessively inherited defect which is known to occur in rabbits (Koyanagi, 1921).

These degenerative changes are very like a form of retinal degeneration which has been observed by one of us (K. T., unpublished observation) in an inbred stock of albino rats and which was found to be inherited and often associated, possibly fortuitously, with coloboma of the optic-nerve sheath. They cannot be due to the vitamin-A deficiency in these rabbits, since the eyes in which they occurred were either from a control animal (A9) or were not removed until all macroscopic signs of deficiency had disappeared as a result of treatment with vitamin A; whereas several enucleated eyes, showing obvious corneal and conjunctival changes, had perfectly normal retinas. Three of the affected animals were litter mates (A7, A8, and A9) and this suggests that we have here an inherited retinal degeneration similar to that already observed in rats. These particular abnormalities were not present at birth in the rat, but appeared about two months later and gradually progressed during the life of the animal.

The occurrence of retinal abnormalities of this type is not uncommon in inbred rat stocks, and the present observations suggest that this may also be the case in rabbits. It is, therefore, of the first importance to make sure that any retinal degeneration observed never appears in litter mates of the same age before ascribing it to vitamin-A deficiency.

In general, the results of these experiments indicate that vitamin-A-deficient rabbits do not show the retinal changes which occur in rats, dogs, and horses.

PLASMA VITAMIN A

It is of importance in assessing the value of slitlamp examination of the cornea in the early diagnosis of vitamin-A deficiency to know the relation between the blood level of vitamin A and the time of detection of the earliest eye signs. It is well known in man that nightblindness can be demonstrated before conjunctival and corneal changes become visible to the naked eye, yet few estimations of the plasma and carotene levels of vitamin-A-deficient animals appear to have been reported and related to eye signs. Rao (1936) reported that the liver of a vitamin-A-deficient rabbit showing xerophthalmia gave a negative antimonytrichloride test for vitamin A, and L. A. Moore (1939) found a rise in plasma carotene after feeding lucerne to vitamin-A-deficient calves which were nightblind but did not show corneal changes.

In our series of rabbits, the plasma carotene and vitamin A were estimated at irregular intervals, both during the establishment of the deficiency and during its treatment. Little or no plasma carotene was found, for the rabbit converts this rapidly to vitamin A. Briefly, we found that the plasma-vitamin-A values sank to about 10 percent or less of the normal before any sign of deficiency could be observed in the eyes with the slitlamp microscope (table 2). The reestablishment of a normal blood level of vitamin A lagged behind apparently complete cure of the eyes. This is in accord with Lewis *et al.* (1942) who found that, in rats, retinal vitamin A remained high when blood and liver concentrations were reduced and that small doses of vitamin A, given to deficient animals, increased the retinal concentration to normal before there was much change in the blood vitamin A and before any detectable amount was laid down in the liver. Failure of

TABLE 2
RELATION BETWEEN PLASMA VITAMIN A AND EYE SIGNS

Rabbit No.	Plasma A I.U./100 ml.	Eye Signs	Plasma A of Control Litter Mate I.U./100 ml.
1	57	normal	150-177
	10	generalized corneal & conjunctival change	150-177
3	45	normal	150-177
	26	normal	150-177
11	73	normal	
	10	epithelial change just starting	
12	53	normal	
	15	epithelial change just starting	
23	10	very early corneal change	
31	10	normal	105
40	26	slight corneal and conjunctival change	104

dark adaptation in man can occur when the blood vitamin-A level is only slightly below normal, although individual variation makes the normal difficult to assess. The corneal and conjunctival changes that we have been describing must be considered as late changes relative to change in the level of vitamin A in the blood and probably to any change in dark adaptation.

One cannot argue directly from these results that corneal and conjunctival changes in man also will not be microscopically visible until the plasma vitamin-A level has fallen to about 10 percent of its normal value, but one must consider it as a possibility.

SUMMARY

1. Biomicroscopic and histologic

changes in the eyes of vitamin-A-deficient rabbits have been observed and correlated with plasma-vitamin-A levels.

2. Plasma vitamin A was found to drop before any biomicroscopic change was visible.

3. The conclusions of earlier workers that the eye changes are primarily due to an epithelial change in the cornea and conjunctiva are substantiated.

4. Keratinization of the cornea and conjunctiva clears up very rapidly on treatment with vitamin A. Removal of conjunctival pigment and reestablishment of the conjunctival mucous cells takes place more slowly.

It is a pleasure to thank Dr. H. Carleton for his help in preparing the photomicrographs.

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THE MANAGEMENT OF INTRAOCULAR FOREIGN BODIES IN MILITARY PRACTICE*

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Because ophthalmic care is so highly specialized, Army medical authorities found it desirable to designate certain hospitals in each theater of war as ophthalmic centers. The 64th General Hospital* was thus designated in April, 1944, and by successive directives continued to serve in that capacity until V-E Day. When the Hospital was first made the ophthalmic center for its area, it was established at Maddaloni, Italy, 45 miles below Cassino, and received large numbers of casualties during the heavy fighting there, particularly during the breakthrough in May. In August it was moved to Leghorn, 12 miles from Pisa, which the Germans still occupied, and for a month it received casualties directly, since there were no evacuation or field hospitals ahead of it. When the Gothic Line was breached and the Allied troops went forward, the situation again changed, and casualties again passed through evacua-

tion, field, and general hospitals, sometimes not reaching the ophthalmic center at the 64th General Hospital until several days after their injuries had been sustained.

It is my purpose in this paper to summarize the observations made and the treatment employed in the management of intraocular foreign bodies during my service as head of the Ophthalmic Department of the 64th General Hospital. The data and conclusions are based on (1) a number of patients cared for at the 64th General Hospital immediately after being injured, who had received no preliminary treatment; (2) a number of patients cared for soon after being injured who had received treatment at a field or evacuation hospital; and (3) a number of patients cared for after a considerable period of time had elapsed since injury, who had been transported from a long distance, through field, evacuation, or other general hospitals. Total number of cases consisted of 311 eye injuries, with 252 battle casualties, 81 intraocular

* From the 64th General Hospital, Italy (the Louisiana State University unit).

foreign bodies, 14 double perforations of the globe, and a number of intra-corneal, intrascleral, and intraorbital foreign bodies.[†]

In the War Between the States, according to Hughes,¹ injuries to the eye accounted for 0.5 percent of all wounds. In World War I the proportion rose to 5 percent. Detailed statistics on casualties



Fig. 1 (Haik). Case 1. Foreign body (shrapnel) lodged in apex roof of orbit having entered through vertex. Roentgenologic examination at operation with probe *in situ*. Transorbital removal.

for the present war are not yet available for publication, but probably the percentage of injuries of this type will show the same progressive increase noted in all the wars of the last century.

The actual incidence of injuries to the eye is even higher than published statistics indicate, for at least two reasons: In the first place, statistics are usually made up without regard to cerebral injuries with which wounds of the eye are as-

sociated. At the 64th General Hospital, for instance, some 10 percent of the intracranial foreign bodies observed entered through the orbit (fig. 1), the eye being irrevocably damaged in most instances in which the patients survived. In the second place, the incidence of foreign bodies is not always apparent in the immediate tabulation of injuries. It is augmented by the cases in which the injury is not immediately apparent, usually because of the predominance of associated wounds of the face, but becomes evident only by the later development of posterior uveitis. In many cases, of which the following is an example, the foreign body enters the eye without the soldier's knowledge of this phase of his wounds.

Patient 1 was admitted to the Ophthalmic Center at the 64th General Hospital from another general hospital five days after the development of an acute chorioiditis of unknown etiology; several months previously he had been treated for wounds of the face. Examination with the slitlamp revealed a small hole in the iris, and upon roentgenologic examination (fig. 2 a, b) an intraocular foreign body was localized. Its removal resulted in almost immediate subsidence of the uveitis. Incidentally, the case illustrates the importance of roentgenologic examination in every instance of uveitis in young individuals, particularly those who have been in combat, for the demonstration of a possible foreign body (case 2).

OPHTHALMIC SURGERY UNDER WARTIME CONDITIONS

An increasing incidence of injuries of the eye would naturally be expected as warfare becomes increasingly mechanized. On the other hand, in spite of the increase in the number of such injuries, the careful application of modern therapeutic methods gives ground for hope of

[†] Acknowledgment is made to Major Arthur V. Hayes, Gulfport, Mississippi, for invaluable aid in the management of these cases.

a decrease in the number of cases of both absolute and relative ophthalmic disability. The experience of the Ophthalmic Center at the 64th General Hospital supports this hope.

Since foreign bodies furnish one of the major ophthalmic problems of military service, it is fortunate that, even before hostilities commenced, the old concept—an eye containing a foreign body

seem. A devastating inflammation may be the result of such conservatism, as the following case shows:

Patient 2, who was wounded in action by a mortar-shell fragment, reached the 64th General Hospital 14 days later, after passing through an evacuation and then a station hospital. The only previous treatment had been the instillation of at-



Fig. 2. (Haik). Case 2. A, Ring method of localization of foreign body. B, Sweet and ring method of localization.

is potentially lost and must be promptly enucleated—was disappearing. The optimistic concept of other observers that many foreign bodies can be left in the eye without risk has been somewhat slower to disappear, however. With the possible exception of small particles of glass, aluminum, and certain new plastics, which are apparently inert, there is no ground for such optimism. All other foreign bodies, as the result of electrolysis and oxidation, act as irritants, and sooner or later may give rise to a chemical endophthalmitis. Certain special objects induce special varieties of inflammation. Those containing steel and iron, for example, give rise to siderosis bulbi, and objects containing copper give rise to chalcosis.

It is true that the removal of a foreign body from the eye is never unattended by risk. On the other hand, the risk is a calculated one, and is far less, most observers now believe, than that of permitting a foreign body to remain in the eye, however innocent its presence may

ropine twice daily. Examination showed a small metallic foreign body in the lens of the left eye (fig. 3). The lens seemed otherwise undamaged, and the eye showed no hemorrhage and no evidence of an inflammatory reaction. The patient had a severe bronchitis, and for this reason, and because the eye was quiet, no immediate treatment was instituted with respect to the eye. For eight days his course was uneventful. Then he suddenly presented a severe chemical endophthalmitis. Immediate Sweet localization revealed the foreign body lying 2.5 mm. below the horizontal plane, in the midline, 9 mm. behind the center of the cornea. It was removed (the patient under sodium-pentothal anesthesia) with a large magnet supplemented by the cataract knife when the particle had reached the surface of the lens. Postoperative therapy, in addition to the usual local measures, included triple-typhoid vaccine and penicillin. Recovery was stormy, and when the patient was evacuated to the United States, he

had only poor light perception.

Ophthalmic surgery in wartime is attended with many difficulties. There is no branch of medicine that requires greater deliberation and delicacy, and there are fewer qualities more difficult to achieve in the circumstances of war, even in rear areas. In the forward areas, where the majority of injuries are sustained, the first attention is concentrated on saving



Fig. 3 (Haik). Case 3. Sweet method of localizing foreign body; foreign body 16 mm. in length, removal posterior sclerotomy. Visual results 20/30.

life, and other injuries often take precedence of injuries of the eye. Transportation to the rear areas is usually remarkably rapid, but necessarily depends upon the exigencies of combat; there are often unavoidable delays, even in injuries in which good results depend in large measure on prompt specialized treatment, while methods of transportation are often far from desirable.

Other difficulties also exist. The removal of foreign bodies from the eye by magnet is, generally speaking, the simplest method, but the proportion of non-magnetic foreign bodies steadily increased during the war, as aluminum and magnesium alloys were increasingly substituted for brass and steel. Foreign bodies which enter the eye in combat are frequently larger than those seen in civilian practice, and, because of their high explosive origin, they frequently enter with great force and do great structural damage; the degree of explosive force, indeed, is more important than the length

of the laceration through which the body enters the eye. The size of the object, though important, is not necessarily the deciding factor in the end result. At the 64th General Hospital some eyes were enucleated when the size of the object was less than 1 mm. in length, and others were saved when the length was more than 14 mm. (case 3).

The most important consideration in the end results of the surgery of foreign bodies is the condition of the eye when the patient is first seen, which implies that the earlier he is seen the more likely that results will be favorable. Generally speaking, foreign bodies must be removed within 48 hours after entrance, if an advanced chemical endophthalmitis is to be prevented. I have observed cells in the anterior chamber of the eye within an hour after injury, but as a rule, the most devastating inflammatory reaction does not occur for four to six days, as the following case illustrates:

Patient 3 was admitted to the 64th General Hospital six days after his left eye had been injured by shrapnel. When he was seen at an evacuation hospital, soon after the injury, his visual acuity was 20/30. The ophthalmologist there was of the opinion that he had suffered a double perforation of the globe and that the foreign body had entered a few millimeters from the limbus. The roentgenologist believed that the object was extraocular. For five days the soldier's course was uneventful. Then a severe chemical endophthalmitis developed, associated with a hazy cornea and numerous deposits on the posterior corneal surface. The iris was of a sickly green color and the aqueous was fixed. As soon as the patient reached the 64th General Hospital an intraocular foreign body was removed. Postoperative therapy included atropine instillations, foreign-protein therapy, and

sulfadiazine. Vision in the injured eye was 20/200 on discharge (case 4).

Important as is prompt attention to eye injuries, the belief that it is better not to attempt the removal of foreign bodies in forward areas, except in cases of extreme emergency grew steadily throughout the war. The delay in treatment which this policy involved was obviated, when circumstances permitted, by giving patients with such injuries priority in air evacuation. There were at least two good reasons for this policy. In the first place, intraocular hemorrhage, one of the most frequent causes of poor results in ophthalmic surgery, is likely to occur as the result of an initial injury and to be increased as the result of additional movement and manipulations; the length of time that the usual patient remained in an evacuation hospital was not sufficient to overcome this risk. In the second place, neither personnel nor equipment was

likely to be highly specialized in forward areas, and the accurate roentgenologic localization essential for the removal of deep-seated foreign bodies was almost impossible to carry out in front-line hospitals. In one series of 17 cases in which

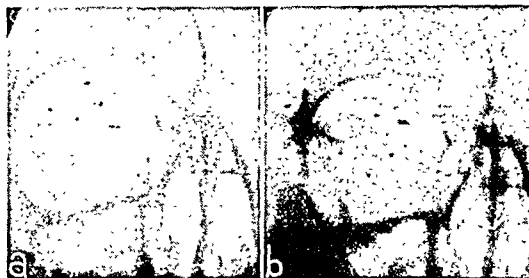


Fig. 4 (Haik). Case 4. Localization of foreign body by Waters method with lead beads on limbus at the 12-, 3-, 6-, and 9-o'clock positions. a, Patient looking upward. b, Patient looking downward.

foreign bodies were removed at the 64th General Hospital, attempts at removal in forward areas had been unsuccessful in 15, undoubtedly because accurate localization was impossible.

Within the limits of the potential seriousness of intraocular foreign bodies, the results at the Ophthalmic Center of the 64th General Hospital were good. There were some tragic cases of complete blindness, but, as a rule, vision was preserved in the injured eye. It would be less than fair not to emphasize that whatever results were achieved at this center were by no means the achievement of the ophthalmic surgeons alone. For one thing, equipment was excellent. For another, the ophthalmic staff had the singular good fortune to have the coöperation of a competent and interested roentgenologic staff. In addition well-trained and enthusiastic nurses* and enlisted men† provided the

TABLE 1
ANALYSIS OF 81 CASES (11 BILATERAL) OF INTRA-
OCULAR FOREIGN BODIES TREATED AT THE
OPHTHALMIC CENTER OF THE 64TH
GENERAL HOSPITAL

Location	Num- ber*
Anterior chamber.....	9
Lens.....	7
Vitreous or retina.....	
Entrance through cornea, iris, and lens	25
Entrance through cornea and iris....	8
Entrance through sclera.....	32
Agent	
Mortar shell fragments.....	18
Other shell fragments.....	20
Mines.....	11
Grenades.....	9
Sniper's bullets.....	4
Hammer or chisel.....	12
Undetermined.....	7
Results	
Removal.....	63
Enucleation.....	7†
Evacuated in situ to United States.....	11

* These figures do not include 14 cases of double perforation of the globe, and a number of intraorbital and intrascleral foreign bodies.
† 2 magnetic, 5 nonmagnetic.

* Lieutenants Margaret Sexton, Mary Lowrance, Blanche Buquoi, Dorothy Rose, and Margaret Yound, and Miss Adelaide Stoll, A.R.C.

† Sergeants Lou Sadecky, David Reiss, and David Brein, and Corporal Ted Smeigilski.

patients with care which compared most favorably with that provided for such patients at the best hospitals in the United States.

The great majority of the intraocular foreign bodies observed at the 64th General Hospital, as an analysis of 81 typical cases shows (table 1), was of direct-combat origin or was combat-connected. Most of the others were sustained in the repair of vehicles, welding, chiseling, and similar activities. It must not be forgotten that a civilian life of sorts goes on behind the lines, and that injuries similar to those encountered in civilian life also occur. Singularly few injuries were due, as Stallard² expressed it, "to the stupidities of fools, who, in spite of warnings, dismantled mines and grenades, threw them about, suffered road injuries, etc."

DIAGNOSTIC CONSIDERATIONS

Preëxamination care. Ideally, all soldiers with injuries of the eye were evacuated lying down and remained thus until the character of their wounds was determined, for the reason, already emphasized, that hemorrhage as well as loss of vitreous is a risk in all injuries of the eye and that the risk is increased many times by voluntary movements and careless handling. Practically, many soldiers not disabled by other wounds were received sitting up or even walking.

On admission to the Hospital, any patient with a suspected wound of the eye, regardless of its type, was immediately placed on a litter. He was moved very gently and was cautioned to keep both eyes closed, as if asleep, and not to make movements himself until the character of his injury was established.

History. In civilian practice, the history of an injury of the eye is frequently use-

ful. It provides data concerning not only circumstances of the accident and the kind of foreign body, but usually also its force, direction, and possible infectiousness. In military injuries, the history is seldom of value, for even the type of weapon or shell used is often unknown. Therefore, potential infection must be assumed in all cases, regardless of the circumstances, although it may not be evident if the patient is seen promptly.

Examination. In cases of simple unilateral injury, the patient was placed in a partially darkened room, and pontocaine (0.5 percent) was instilled into both eyes before the examination. For more serious injuries, particularly the bilateral, local analgesia was secured with 4-percent cocaine solution, and adrenalin (1:1,000 solution) was instilled into the eyes in 2-drop amounts for four doses at 4-minute intervals. During this interim, sodium pentothal was administered intravenously, and no attempt at examination was made until the patient was fully relaxed. Black-silk sutures (4-0) were then placed in the upper and lower lids, in the areas in which procaine had been injected, and were used for purposes of retraction.

Thorough inspection with direct illumination was the first step of the examination. If hemorrhage and inflammation had not obscured the field, it provided useful information. In the majority of cases this was, unfortunately, not true. Hemorrhage had obscured the field, and the fundus reflex was absent. The examination was continued with the loupe and the ophthalmoscope; the slitlamp was used when feasible. The findings were correlated with the roentgenologic findings before any decision as to procedure was made.

Before discussing roentgenologic considerations, however, certain diagnostic considerations must be emphasized. It

was never assumed, because the lids were closed by hemorrhage or edema, or both, that the injuries were confined to the lids. These were gently retracted and intraocular foreign bodies were searched for, although it was sometimes necessary to delay the examination until compresses and other measures had reduced the edema and made manipulation possible without inflicting additional trauma. Intraocular examination was particularly necessary in cases of multiple wounds of the face, especially if edema and inflammatory reaction had already occurred when the patient was first seen. War ophthalmology provided no more difficult problems than delayed cases in which these changes had already obscured the intraocular field. The eyes in each such case were, therefore, thoroughly examined (the patient under sodium-pentothal anesthesia) and, if necessary, explored.

While the presence of a visible laceration of the cornea or sclera was regarded as presumptive evidence that a foreign body might have entered the eye, the absence of a visible wound was not considered adequate proof that it had not. A thin, small metallic fragment may leave no gross evidence of its entrance, particularly if some time has elapsed since the accident. When the staff of the 64th General Hospital worked close to the forward lines, or when patients were evacuated to it by air, the wound of entrance was usually visible. As the line went forward, or when patients were not seen until 24 hours or more had elapsed since their injuries, the wound of entrance was usually sealed and could not be demonstrated by any method of examination.

A prolapse of any portion of the uveal tract or of the vitreous, or a shallow deformity of the anterior chamber was regarded as *prima facie* evidence of a perforating wound with a possible intraocular foreign body.

A self-retaining retractor was never used in the search for a foreign body because it would exert pressure on the eyeball and contribute to the danger of loss of vitreous. Attempts to determine the presence of a perforating wound by pressure on the eyeball with the fingers or with a tonometer were also avoided. If a wound is present, such maneuvers inevitably cause the loss of vitreous.

The use of a magnet to test the presence of a foreign body was regarded as equally bad practice. If the body is nonmagnetic, the procedure is merely a waste of time. If it is magnetic, it may lie at too great a distance from the magnet, or be too small, or too deeply embedded in the tissues, to cause even a sense of pain until the instrument can be brought into closer contact with it. More important, if a magnetic foreign body is present and is susceptible to the pull of the magnet, a great harm may be done by even slight movement under noncontrolled conditions. Stallard's² suggestion that if fragments of the foreign bodies embedded elsewhere in the body can be removed, they should be examined roentgenologically to determine their constituents, seems to have definite limitations; for various explosives are made up of several different types of material. Some detonators, for example, as well as grenades and mines, consist of 90-percent nonmagnetic and 10-percent magnetic material. Furthermore, all the foreign bodies in a single case of injury are not necessarily of the same origin. Therefore, the practice of taking a foreign body from the face or other parts of the body to determine magnetism was not believed to be a reliable procedure.

ROENTGENOLOGIC EXAMINATION

Roentgenologic examination is the basic diagnostic method in cases of intraocular foreign bodies. Its success de-

pendes chiefly upon the roentgenologist, since the ophthalmologist does not usually have the requisite training to employ it. Collaboration between the two staffs is therefore essential. At the 64th General Hospital it was the practice for a member of the ophthalmologic staff to be present throughout the roentgenologic examination, and both staffs were thus familiar with all details of all cases.

Examination began with a postero-anterior view of the skull, followed by a lateral view, in all cases of suspected intraocular foreign bodies and of all multiple wounds of the face. The use of the Waters position excluded the confusing shadow of the petrous bone. A quick reading of the wet films was followed by accurate localization by two methods. First, a silver ring 22, 24, or 26 mm. in diameter, was slipped into the cul-de-sac after local analgesia with pontocaine had been achieved. A double exposure on the same plate was taken with the patient looking upward and then looking down, and a second double exposure was taken on another plate, with the patient first looking to the right and then to the left. Then, an accurate Sweet's localization was done and, if there seemed a chance of error, was repeated at the same sitting. The coördinates and master charts which were now available eliminated much of the tedious calculation formerly necessary in applying this method. The localization of the foreign body by the Sweet method was checked against that indicated in the postero-anterior view, and if the lateral and vertical films varied, localization was repeated until all the films agreed.

Special precautions were taken in all roentgenologic examinations. Certain cassettes were used only for eye work, and were kept scrupulously clean. All exposures were rapid. The importance of co-operation was stressed to the patient, and no distracting movements and noises were

permitted in the room. All films were checked while the patient was in the department and were repeated at once if there was any doubt as to their clarity. Only a few technicians, all of whom were carefully trained, were assigned to this work. They worked accurately because they knew that films must be made over if the findings of all methods of examination did not check with each other.

Errors are inherent in any method of localization, the most frequent arising from movements of the eye. In postero-anterior films this error was eliminated by having the patient look with the uninjured eye into an angled mirror at an object located laterally to him. If both eyes had been injured, the insertion of a silver ring helped to localize foreign bodies but did not completely exclude the error of movement or angulation of the eyeball or of the ring. The ring in a number of measured cases averaged 8 to 10 mm. behind the center of the cornea.

Several errors are possible in a double exposure on the same film, one of the most important being that a minute foreign body may not show up because it receives only half of the exposure ordinarily received. The foreign body may seem to be intraocular, while actually it is in the muscles, orbit, or fat, or in Tenon's capsule. Its presence in the eyelids was excluded by holding the lids open. Injection of air into Tenon's capsule followed by roentgenologic examination at several different angles, frequently clarified cases in which the foreign body had perforated the globe and lay just outside the sclera.

In several cases I found it possible to localize a foreign body by the use of four small lead beads sutured about the limbus in four different positions (case 5). Even if the patient should move, the foreign body was always in the same relationship to the beads. Sweet localization was done



Fig. 5 (Haik). Case 5. A, Localization of foreign body 1 mm. in diameter. Lead bead at limbus, ring method. Sweet method of localization. B, Lead beads at limbus, ring method, Waters's view. Foreign body removed on third attempt through posterior sclerotomy.

with the beads *in situ*, and the results of the two examinations were checked against each other. This method is much simpler than the use of a contact lens (case 6), which is undesirable because it introduces additional trauma and because its fit is only fair at best, eyeballs varying greatly in size and curvature, and estimates of the degree of error being only approximate. Stereoscopy associated with the lead beads and ring often furthered localization.

If the particle was so small that its shadow did not appear on the first film, repeated films of different densities often revealed its position. The use of dental films for the anterior segment was considered important for the demonstration of small foreign bodies of low density.

When it was feasible, a repetition of the examination by a second roentgenologist, or a rereading of the plates, particularly if they had been read while wet, proved useful. Fluoroscopy was disappointing. Its only real value was in the case of nonmagnetic foreign bodies, which as a rule were of such low density or of such small size that they were obscured by the bony structures.

It was the practice at the 64th General Hospital to explore the injured eye in

the region of the injury when the foreign body showed up in the double-exposure film as moving. The results of the examination were often inconclusive, and it was believed that the calculated risk of the operation was less than the risk of permitting a suspected intraocular foreign body to remain in the eye. It was also the practice to explore the eye in any case wherein there was reason to doubt a negative roentgenologic report



Fig. 6 (Haik). Case 6. Localization of foreign body with contact lens and lead beads. Angled mirror is in front of uninjured eye. Posterior sclerotomy removal.

and in any case wherein accurate localization was not successful, particularly if the foreign body were located 2 to 3 mm. from the sclera.

Mention should also be made of the foreign-body locator devised by Lieut. Col. Henry Carney on the principle of the apparatus used for detecting mines. While it was devised to locate foreign bodies elsewhere in the body, it was modified for use in the eye. It came into use shortly before the end of the fighting in Italy, and proved of value in confirming the X-ray findings.

OPERATION

The use of local analgesia was undesirable in military hospitals. The patients were frequently worn out and in a state of nervous tension when they were admitted; moreover, the inflammation so often present made complete anesthesia preferable. Sodium-pentothal anesthesia, supplemented by local analgesia, proved an ideal combination. It permitted maximum relaxation, and it was seldom necessary to section a muscle to expose the posterior sclera, which was often necessary when only local analgesia was used.

After the eyelashes had been clipped, the face was thoroughly washed with white soap and water, great care being taken to avoid pressure on the eyelids and eyeballs. The face was then wiped with 70-percent alcohol followed by tincture of merthiolate. Finally, argyrol in 10-percent solution was instilled into the eyes and was removed with copious irrigations of warm boric-acid solution.

Route of approach. Extraction of a foreign body through the wound of entrance was seldom feasible—a new incision usually had to be made. It was so placed as to permit removal of the object with the least possible trauma, and it was made

longer than the object, to prevent further tearing, since a controlled incision heals more readily than one with jagged edges. Although there continues to be argument as to whether removal should be by the anterior or the posterior route, there seems little reason for disagreement. It seemed only logical to place the incision so as to permit the most direct approach to the object. Fragments of missiles were likely to be irregular and rough; hence damage to the ciliary body, iris, lens, and other structures was almost inevitable if these fragments were dragged through the whole extent of the eye in order to remove them by way of a corneal incision. An additional reason for placing the incision as near the foreign body as possible was that the magnetism of many modern instruments of war was so low that the magnet, to be effective, had to be placed near the object.

Prejudiced adherence to either the anterior or the posterior route was regarded as equally unwise. As a general rule, however, when the foreign body lay more than a few millimeters beyond the posterior capsule of the lens, it was usually considered wiser to remove it through a posterior rather than an anterior incision.

Points of technique. The technique employed for posterior sclerotomy was simple. The affected area was completely cleared of conjunctiva, Tenon's capsule, and episcleral tissue. A black-silk suture (4-0) in the sclera was used as a retractor. A black-silk suture (7-0) on an atraumatic needle was introduced into the sclera just to one side of the foreign body for a depth of 0.1 mm., and a similar suture was introduced on the same level and to the same depth, just to the other side. An incision was made between these sutures, down to but not through the choroid, and the foreign body was re-

moved by magnet or forceps according to the indications; it was extremely important in dealing with minute foreign bodies to expose the choroid in view of their low magnetism. After the sutures were tied, the area about the incision was coagulated with the diathermy needle, to prevent detachment of the retina, a considered task in transcleral extraction. The episcleral tissue and Tenon's capsule were enclosed with interrupted silk sutures, care being taken that the incisions in the conjunctiva and sclera did not lie one above the other.

Corneal incisions and wounds were usually covered with conjunctival flaps and were sutured with atraumatic needles and with very fine black silk. The sutures did not penetrate more than half the thickness of the tissues.

If the foreign body lay in the anterior chamber or iris, eserine was instilled before the operation to contract the pupil, to keep the foreign body away from the lens, and to help prevent prolapse of the iris when the surgical incision was made. If the foreign body had perforated the lens and was lying in the vitreous posterior to it, making removal of the lens necessary, it was found that the best plan was to make the corneal opening just large enough to remove the foreign body, and to extract the lens at a second operation. This seemed advisable because vitreous is always present in the lens substance, and a large amount is likely to be lost if the lens and foreign body are removed together.

When a foreign body had been in the eye for any length of time, the vitreous was likely to be fluid and a large amount could easily be lost when the sclera was incised. Frequently, even a vitreous of normal consistency bulged into the wound. If this happened, the bulging portion was clipped off with scissors before the sutures, already placed, brought the cut edges of the sclera together.

Magnets. The small magnet, which was the only kind available in evacuation hospitals, was always used before the large magnet, if only because it was less awkward to manipulate. If it failed, the large magnet was applied. In the 64th General Hospital, successful removal of foreign bodies with a large magnet was possible in several cases in which the small magnet had previously failed. The difference between the two instruments, it should be emphasized, is not the increased magnetic attraction of the larger instrument, but the increased size of the magnetic field. Regardless of which is used, varying the distance between the patient and the tip of the magnet controls the degree of pull. In the ideal case, the tip of the magnet is applied either directly to the foreign body or at a distance of not more than 2 mm. Only after repeated attempts at more conservative methods have failed should probes, scissors, and other instruments be applied to the tip of the magnet, because when instruments are introduced into the vitreous, trauma is increased.

A magnet, whether large or small, was always used cautiously. It was never brought to the eye while alive. It was never used until the location and size of the foreign body had been determined as accurately as possible and the method of removal had been decided upon. Finally, it was introduced into the wound, as near the foreign body as possible, before the current was turned on. Repeated applications were sometimes necessary, and success was often achieved in most unlikely cases. Wright and Duncan³ have recently reported two such instances. In the first 6/6 vision was preserved in a German prisoner after 35 applications of the magnet and in the other 6/9 vision was preserved in an English soldier after 75 applications totaling 10 minutes and ranging in duration from 4 to 15 seconds, in the course of four operations.

Enucleation. Although enucleation is now a last resort in the management of foreign bodies, it was sometimes found to be the wisest procedure in the occasional case in which the object had damaged all the tissues of the eye in its passage or in which there had been a long delay before hospitalization, with the development of serious infection. When the injury was bilateral, it was particularly important to delay radical surgery. Sometimes the eye which on the first examination seemed in worse condition later proved to have better vision.

Experiences at the 64th General Hospital bore out the value of conservatism. In some cases as many as three attempts to remove the foreign body failed, but, unless the eye became painful and soft or light perception was permanently lost, enucleation was still delayed. In one such case, the result of an explosion of a 37-mm. gun, three attempts to remove a fragment (probably of aluminum) in the vitreous failed at this hospital. A fourth attempt in the United States also failed. Exploration was carried out through both the anterior and the posterior routes. The eye, however, remained quiet, and good vision was maintained. When the soldier was first seen, other, more superficial fragments were removed without difficulty from both eyes. Some of these were magnetic; others, nonmagnetic. Roentgenologic examination was negative in this case, the foreign body having been seen only by ophthalmoscopy.

The development of chemical endophthalmitis, even if severe, was not regarded as indication for immediate enucleation if the foreign body could be removed. In numerous cases treated at this hospital, the infection was controlled by foreign-protein therapy, and at least partial vision was preserved. The staff also took the position that because of the risk of sympathetic ophthalmia, immediate enuclea-

tion was not indicated in cases of injury involving the ciliary body. In a number of instances, in one of which the fragment was a 16-mm. piece of shrapnel, the foreign bodies were removed and useful vision was retained. All such cases were followed up for a minimum of three months, and no instance of sympathetic ophthalmia was observed during this period.

POSTOPERATIVE CARE

At the conclusion of the operation, 5-percent atropine sulfate was instilled into the eye, followed by sulfanilamide powder and 5-percent boric-acid ointment. The eyes were covered by a binocular bandage, and at the end of two weeks a pin-point shield was permitted on the uninjured eye. It proved impossible to keep the injured eye at rest if only a monocular bandage was used. The patient was warned against violent or abrupt movements, was kept in bed for seven or eight weeks, and was so supervised by the nursing staff that these instructions were carried out.

The postoperative management did not differ from the methods used in the usual ophthalmologic case except that atropine sulfate was used in 5-percent strength instead of in the usual 1-percent strength. This was necessary because of the difficulty of securing good dilation of the pupil in young men, the majority of whom have unusually strong sphincters.

It was standard practice in all eye injuries to begin the administration of penicillin in the evacuation or field hospital; 25,000 Oxford units was administered every three hours with as little interruption as possible until 2,500,000 units had been given. Before May, 1944, when penicillin first became available, sulfanilamide and its derivatives were used in all eye injuries.

Foreign-protein therapy was begun in

cases of perforating wounds as soon as the patient reached the General Hospital. Fresh milk was not obtainable; but canned milk, which, so far as I know, has not previously been used in foreign-protein therapy, gave excellent results. It was used in 5-c.c. amounts, mixed with 5 c.c. of distilled water, and was given five times every third day. No abscess resulted in more than 1,000 injections. The use of typhoid vaccine was usually undesirable when the patients were first seen, because many of them were in poor condition, if not in acute shock; however, if the eye continued irritable, it was employed later.

Infection was most likely to occur when the wound of entrance was through the cornea, and least likely to occur when it was through the sclera. The vitreous, fortunately, is a poor culture medium. In the cases in which chemotherapy had been instituted promptly, surprisingly few infections were observed at the 64th General Hospital, even when the patients were received late. Postoperative complications under the regime outlined were inconsequential.

SUMMARY AND CONCLUSIONS

The highly mechanized nature of modern warfare has caused a great increase in the number of injuries of the eye, but the application of modern therapeutic methods gives rise to the hope that the percentage of permanent and relative disability may be smaller than in previous wars.

Foreign bodies furnish one of the major ophthalmologic problems of military service. Their removal is never simple, but the risk of operation by a competent ophthalmologic surgeon, and under proper conditions, is less than the risk of their retention. Enucleation of the injured eye should be regarded as a last resort and never as the procedure of choice.

The exact localization of the foreign body by roentgenologic methods is the secret of successful removal. More than one attempt at removal may be necessary before success is achieved. Removal by magnet is desirable when it can be carried out, but an increasingly large number of missiles of modern warfare are nonmagnetic. The anterior or posterior approach should be used according to the indications.

The use of chemotherapy (penicillin and sulfanilamide and its derivatives) and of foreign-protein therapy (milk or typhoid vaccine) is successful in preventing and controlling infection in the majority of cases.

The removal of foreign bodies is attended with more difficulties in military than in civilian practices, but preservation of some degree of vision is possible in many unpromising cases. Even if enucleation must eventually be resorted to, the soldier should be given his chance for future vision, since conservation under proper safeguards, is not attended with undue risk.

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THE EFFECT OF SUNLIGHT ON DARK ADAPTATION*

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INTRODUCTION

Cases of night blindness attributed to exposure to excessive sunlight have been reported from time to time over a period of many years.¹ Although in most of these cases some dietary deficiencies may have been a causative factor, it seems likely, in view of recent reports^{2, 3, 4} on night visual disturbances occurring in military personnel, that exposure to bright sunlight may well have been an important contributing factor.

Recently reported are 50 cases of night blindness in the Turkish Army which were apparently due to bright sunlight.² Livingston,³ in a clinical study made in Iraq in 1932, found that constant exposure to sun glare resulted in definite clinical changes that are significantly detrimental to aviation, among other occupations. McCartney⁴ has also reported that exposure to tropical sunlight caused severe night blindness among military personnel in the South Pacific; in most of these cases the day vision remained unimpaired. He states further that cases of night blindness due to sun glare are more severe when other constitutional factors, such as alcoholism, dietary deficiencies, and reduced vitality of whatever cause, are also present.

These reports are substantiated by laboratory studies showing that the speed of dark adaptation is greatly influenced by the brightness of the light to which the eyes are exposed prior to dark adapta-

tion.^{5, 6, 7} For example, it has been shown that adaptation to high intensities of light prior to dark adaptation will not only delay the onset of rod adaptation, but will also delay the attainment of the normal, final dark-adapted threshold. In view of the foregoing and the persistence of reports of night blindness from combat areas in the South Pacific, further investigations on the effect of excessive sunlight upon retinal sensitivity have been made.

Hecht *et al.*⁸ undertook a study at Camp Lejeune in the fall of 1944, with the idea of determining how long the final dark-adapted threshold remains above normal after exposure to sunlight and whether such effects are cumulative in personnel exposed to sunlight day after day over a considerable period of time. They found that after a single exposure of two to three hours, the onset of rod adaptation was delayed for 10 minutes or more and the dark-adaptation process, itself, was delayed so that the normal dark-adapted threshold was not reached for several hours. After repeated daily exposures to sunlight, the night visual threshold remained elevated on an average of 0.11 log $\mu\mu$ lamberts above normal overnight. This degree of elevation amounts to a deterioration of about 50 percent in visual acuity, range of visibility, contrast discrimination, and frequency of seeing. Furthermore, this cumulative effect appeared to have some degree of permanence since it persisted even after 10 days of protection from sunlight.

Although there is ample evidence that prolonged exposure to sunlight has a deleterious effect upon night vision, the Bureau of Medicine and Surgery of the

*From the School of Aviation Medicine, Naval Air Training Bases. The opinions or assertions contained herein are the private ones of the writers and are not to be construed as official or reflecting the views of the Navy Department or the naval service at large.

Navy Department decided that additional data on certain practical aspects of the problem would be valuable. Two problems were considered to be of particular significance to Navy personnel assigned to duties involving the use of night vision: (1) the duration of the effects of sunlight on dark adaptation, and (2) the protection afforded by low-transmission sunglasses during exposure to sunlight.

The Naval Air Training Bases, Pensacola, Florida, offered a suitable place for these studies because there the bright sunlight and high reflectivity of the sand on the beaches closely approximate conditions of illumination found in the islands of the South Pacific. Furthermore, personnel and equipment were available for making the studies.

EXPERIMENTAL PROCEDURE

In the three experiments to be described, the testing of the subjects was done in the Night Vision Training Building, Naval Air Station, Pensacola. The building was ideal for the purpose, since it was lightproof, equipped with air conditioning, and had facilities for illumination by white or dim red light.

In each of the experiments, the subjects were tested in groups of 10 or less. In all cases each subject was dark adapted, prior to testing, by remaining in dim red light for 20 minutes and then in total darkness for 10 additional minutes. The dark-adapted thresholds of both the right and left eyes (or, in one experiment, of the sighting eye) were measured after 30 and 60 minutes of dark adaptation. In certain cases, thresholds were also determined after 90 minutes of dark adaptation.

The threshold measurements were made with a Hecht-Schlaer Adaptometer modified to present a 3-degree circular test patch. This was arranged to measure the monocular threshold of a retinal area

7 degrees above the macula. Each exposure of the test light was for one-fifth second. The method of limits was used to determine the threshold. The intensity of the test patch was decreased in 0.2 log μ lambert steps until the subject did not see two successive exposures. The intensity of the test light was then increased until the subject reported two successive exposures. Ten such series of trials were given, five descending alternated with five ascending series of trials. The average of these 10 measurements was taken as the threshold for each condition of adaptation.

The subjects used in these experiments were obtained from two sources. Two small groups consisted of enlisted men assigned to the Dispensary, NAS, Pensacola. The remaining men were members of seaplane beaching crews attached to Squadron 8-A NATB, Pensacola. In each case, before the experiment was started, the testing procedure and the purpose of the experiment were carefully explained to the subjects. Preliminary thresholds, obtained before the experimental conditions were instituted, served as practice periods to familiarize the men with the testing procedure and provided a basis for comparison with the thresholds obtained under experimental conditions. The men were exposed to sunlight for varying periods of time which will be indicated in the following discussion of the studies.

EXPERIMENTAL RESULTS

THE EFFECT OF EXCESSIVE SUNLIGHT ON THE RETINAL SENSITIVITY OF AN UNPROTECTED AND COMPLETELY PROTECTED EYE IN THE SAME INDIVIDUAL⁹

As a preliminary to an investigation of the protective value of sunglasses, an experiment was made to determine whether the effect of sunlight on retinal

sensitivity of an unprotected and a completely-protected eye could be studied simultaneously in the same individual. This was done by measuring the monocular variation in night visual thresholds of four subjects who had one eye completely protected by a black eye shield during exposure to bright sunlight. After preliminary threshold measurements had

periment, the eye patch was reversed and worn on the left eye.

The combined data are shown graphically in figures 1 and 2. The afternoon data (fig. 1) show the immediate effects of excessive sunlight on the night visual thresholds, whereas the morning data (fig. 2) show any residual effect of the previous day's exposure. The difference

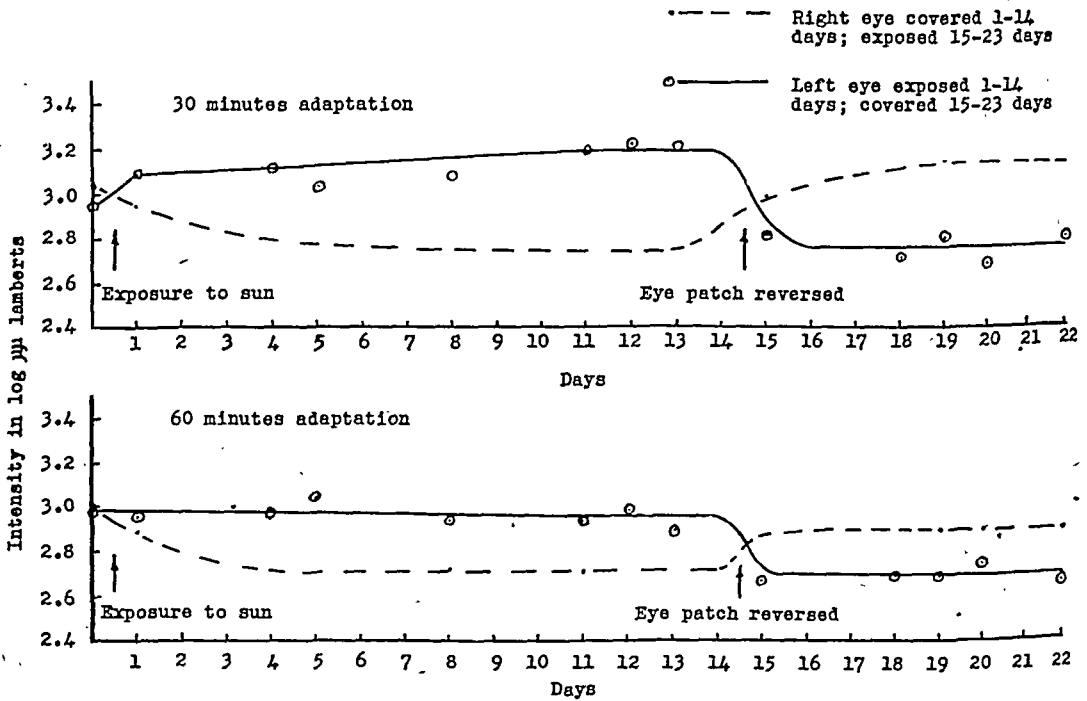


Fig. 1 (Clark, Johnson, and Dreher). Afternoon dark-adapted thresholds.

been made, each man was issued a black eye shield and instructed to wear it over the right eye at all times while out-of-doors except after sundown. The men were sent to Mustin Beach on Penascola Bay every day except Sunday during the experiment. Throughout the experiment every day was sunny and bright. The men averaged 4 hours and 25 minutes a day on the beach, during which time they were permitted to do whatever they wished to amuse themselves, so long as they did not close the exposed eye or protect it from the sun or sand in any way. After the morning tests on the 15th day of the ex-

periment, the eye patch was reversed and worn on the left eye.

in threshold, which was negligible at the beginning of the experiment, may be used as a measure of the effect of sunlight upon the exposed eye.

As would be expected, the effects of exposure to sunlight were most marked in the afternoon, immediately following exposure. It can be seen in figure 1 that the average afternoon thresholds of the exposed eye were always higher than those of the protected eye. After 30 minutes of dark adaptation, the differences in favor of the protected eye ranged from 0.11 to 0.50 log $\mu\lambda$ lamberts, with an average difference of 0.34 log $\mu\lambda$ lam-

berts (table 1). After 60 minutes of dark adaptation, the same effects were present to a lesser degree, the range for the group being 0.07 to 0.30 log $\mu\mu$ lamberts, with an

the threshold of the formerly protected eye rose 0.30 log $\mu\mu$ lamberts above its previous, and presumably normal, level for the duration of the experiment. After

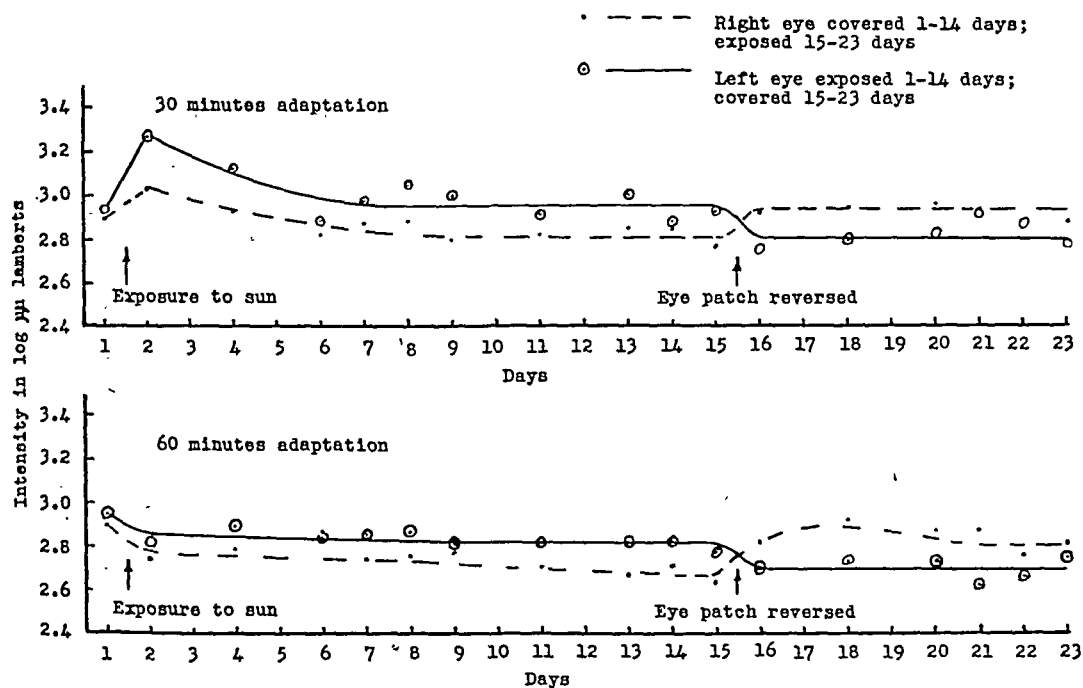


Fig. 2 (Clark, Johnson, and Dreher). Morning dark-adapted thresholds.

TABLE 1

AVERAGE THRESHOLDS OF EXPOSED AND COMPLETELY PROTECTED EYES

	Mean Morning Thresholds in Log $\mu\mu$ Lamberts			Mean Afternoon Thresholds in Log $\mu\mu$ Lamberts		
	Dark-Adaptation Times			Dark-Adaptation Times		
	30 min.	60 min.	90* min.	30 min.	60 min.	90† min.
Exposed eye	2.97	2.84	2.77	3.12	2.93	2.80
Protected eye	2.84	2.72	2.63	2.78	2.72	2.67
Average difference	0.13	0.12	0.14	0.34	0.21	0.13

* Final four days only.

† Final three days only.

average difference of 0.21 log $\mu\mu$ lamberts (table 1).

When the eye shields were reversed on the morning of the fifteenth experimental day, the thresholds taken that afternoon showed marked reversals (fig. 1). After 30 minutes of dark adaptation,

60 minutes of dark adaptation, an elevation of 0.20 log $\mu\mu$ lamberts persisted through the final eight days. On the afternoon of the first day it was protected from the sun, the previously exposed eye, now protected with a black shield, showed threshold drops of 0.35 and 0.25 log $\mu\mu$

lamberts after 30 and 60 minutes of dark adaptation, respectively. Furthermore, the thresholds of the previously exposed eye remained at this lower level through the remaining seven days of the experiment. On the last three afternoons of the experiment, thresholds measured after 90 minutes of dark adaptation showed that the exposed eye had reached in 90 minutes the level normally attained by the protected eye after only 30 minutes of dark adaptation (table 1).

The residuum of the effect of the previous day's exposure is shown in the 30- and 60-minute threshold measurements taken in the morning before the daily exposure to sunlight (fig. 2). The effect here was the same as that found in the afternoon data, except that the decrement of rod function in the exposed eye was less. After 30 minutes of adaptation, the average difference between the two eyes was $0.13 \log \mu\mu$ lamberts with a range of 0.10 to $0.44 \log \mu\mu$ lamberts. Following 60 minutes of adaptation, an average difference of $0.12 \log \mu\mu$ lamberts between the two eyes was present (table 1). After reversal of the eye shields on the fifteenth day, shifts in sensitivity similar to those present in the afternoon appeared in the morning data. The threshold of the formerly exposed eye dropped to the level of the previously protected eye, and that of the previously protected eye (now exposed) rose to the level of the previously exposed eye.

These data reveal effects of exposure to sunlight that are of the same order of magnitude as those found by Hecht *et al.* at Camp Lejeune.⁸ Although the amount of the elevation in threshold is not spectacular, Hecht has pointed out that it is enough to reduce efficiency by approximately 50 percent at threshold levels of intensity. These results differ from those of the Camp Lejeune study, however, in that the effects of the exposure were

found to be only temporary. In the present study, the elevation of threshold of the exposed eye disappeared when the eye was completely protected from light for a period of seven to eight hours during a day, while the other eye was exposed to brilliant sunlight.

A STUDY OF THE EFFECTIVENESS OF SUNGLASSES IN THE PROTECTION OF NIGHT VISION

Two studies were made to determine the effectiveness of Navy-issue sunglasses having 12-percent transmission, polarizing, neutral filters (Sun, N-1, Contract No. NXsX-66884). One was a field study of 20 members of four seaplane beaching crews.¹⁰ The other was a laboratory study made on a group of three men attached to the Dispensary, NAS, Pensacola.¹¹

Field study. The men from the seaplane squadron (Squadron 8-A) were selected because they had been working on the seaplane ramps for a number of months and had been exposed to sunlight from six to eight hours per day during this period. With such subjects it was possible to determine the protection to night vision afforded by wearing low-transmission sunglasses under operating conditions at a Naval Air Station.

After preliminary threshold measurements, the 20 men were divided into two groups. One group was issued glasses and the other was not. The men with the glasses were instructed to wear them at all times while they were out-of-doors. The remaining men carried on their work as usual and thus acted as a control group. The experimental conditions for the two groups were reversed on the fifteenth day of the experiment.

There was a negligible difference between the two groups during the preliminary tests. However, when one group wore the glasses there was a consistent

threshold difference between the two groups, favoring those who were protected. As table 2 shows, the differences in the afternoon thresholds were 0.21 log $\mu\mu$ lamberts after 30 minutes of dark

adaptation and 0.22 log $\mu\mu$ lamberts after 60 minutes of dark adaptation. These thresholds were taken after approximately three hours' exposure to sunlight. As in the previous experiment, the morning data show similar but smaller differences (fig. 3). The average differences in these morning thresholds were 0.17 log $\mu\mu$ lamberts after 30 minutes and 0.15 log $\mu\mu$ lamberts after 60 minutes of dark adaptation (table 2). Due to inclement weather at the time the groups were reversed, the data at this point are somewhat obscure, but there was a trend toward a reversal of the thresholds of the groups. The final point on the curve (fig. 3) is the average from the 18th and 20th days.

The data indicate that the low-transmission sunglasses used in this experiment afford excellent protection to the retinal sensitivity of persons working in

TABLE 2

AVERAGE THRESHOLDS OF EXPOSED GROUP AND SUNGLASS GROUP

	Mean Morning Thresholds in Log $\mu\mu$ Lamberts		Mean Afternoon Thresholds in Log $\mu\mu$ Lamberts	
	Dark-Adaptation Times		Dark-Adaptation Times	
	30 min.	60 min.	30 min.	60 min.
Exposed group	2.88	2.76	2.97	2.83
Sunglass group	2.71	2.61	2.76	2.61
Average difference	0.17	0.15	0.21	0.22

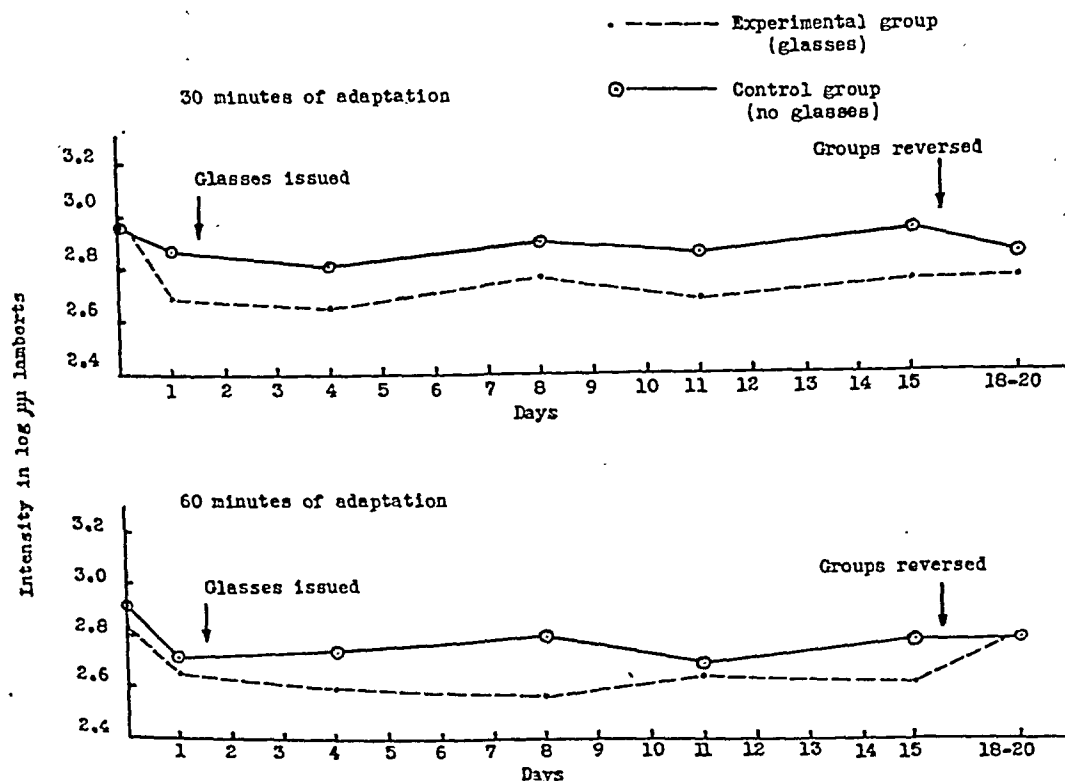


Fig. 3 (Clark, Johnson, and Dreher). Morning dark-adapted thresholds.

sunlight for prolonged periods. The protection is sufficient to result in higher visual efficiency of practical importance to those engaged in visual tasks at night.

Laboratory study. In a more carefully controlled experiment, a group of three men was studied with the same technique

as that employed when the eye shield was used. Here, however, a 12-percent polarizing neutral filter was worn over one eye instead of an eye patch. The exposure to sunlight varied between three and four hours per day.

The results followed the same pattern

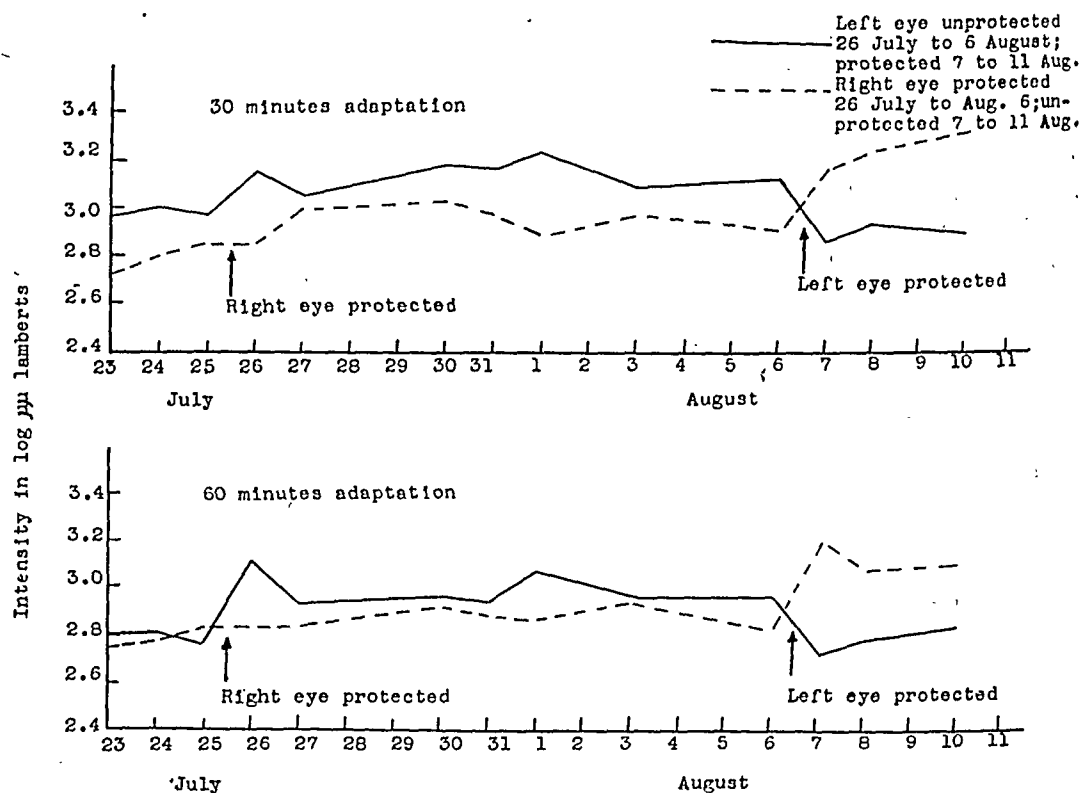


Fig. 4 (Clark, Johnson, and Dreher). Afternoon dark-adapted thresholds. $N = 3$.

TABLE 3

AVERAGE THRESHOLDS OF EXPOSED EYES
AND EYES PROTECTED WITH SUNGLASSES

	Mean Morning Thresholds in Log $\mu\mu$ Lamberts		Mean Afternoon Thresholds in Log $\mu\mu$ Lamberts	
	Dark-Adaptation Times		Dark-Adaptation Times	
	30 min.	60 min.	30 min.	60 min.
Exposed eye	3.05	3.03	3.17	3.04
Protected eye	2.92	2.90	2.93	2.85
Average difference	0.13	0.13	0.24	0.19

found with the eye patch. When the subjects were exposed to sunlight for extended periods, there was an immediate and marked elevation in the threshold of the unprotected eye as compared with the protected eye (fig. 4). After 30 minutes of dark adaptation this amounted to 0.24 log $\mu\mu$ lamberts and after 60 minutes to 0.19 log $\mu\mu$ lamberts (table 3). This higher threshold persisted overnight and amounted to 0.13 log $\mu\mu$ lamberts after both 30 and 60 minutes of dark adaptation in the morning tests (fig. 5, table 3). When the filter was changed to the left eye, there was an immediate reversal of sensitivity in the two eyes. Here again, as

in the eye-shield study, the immediacy of the reversal in threshold sensitivity following reversal of the experimental conditions indicates that the threshold elevation in the exposed eye was only temporary.

These results show clearly that the sunglasses used in this experiment are effective

two weeks show a marked elevation of the night visual threshold immediately following exposure. The degree of elevation persisting overnight is sufficient to cause approximately a 50-percent loss in night visual efficiency. Furthermore, it appears that persons exposed to sunlight for extended periods daily, without pro-

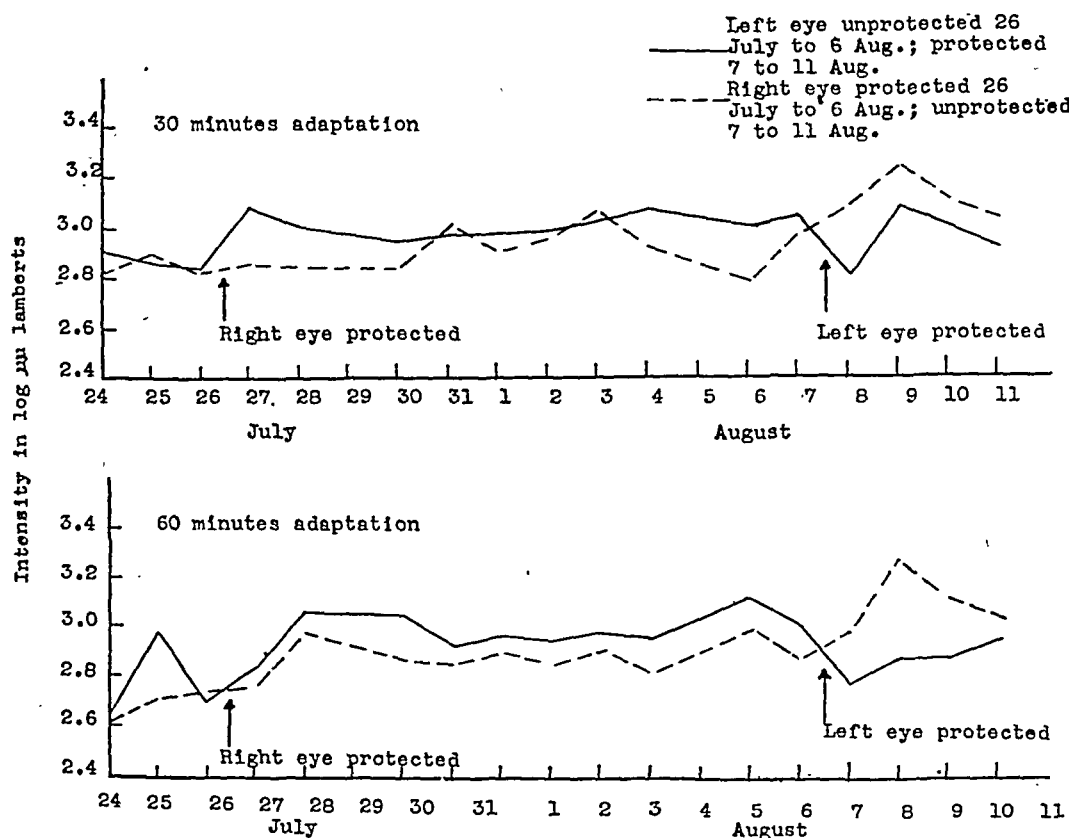


Fig. 5 (Clark, Johnson, and Dreher). Morning dark-adapted threshold. $N = 3$.

tive in providing protection of the retinal sensitivity of persons exposed to sunlight for prolonged periods. They also indicate that the 30-minute period of dark adaptation generally required for obtaining a practical maximum of night visual efficiency is inadequate for persons who have been directly exposed to sunlight for extended periods through the day.

SUMMARY

Individuals exposed to sunlight for three to four hours a day over a period of

tection to their eyes, require in excess of one hour of adaptation to achieve a practical maximum of night visual efficiency. Exposure to brilliant sunlight has been reported as the cause of night blindness that is more or less permanent. However, the present studies on normal individuals indicate that the effects of daily exposure for three to four hours are only temporary, since the threshold returns to normal after one day's protection from the sun.

Persons wearing 12-percent transmis-

sion polarizing sunglasses during prolonged exposure to sunlight had significantly lower night-visual thresholds than those who did not. In view of these results, personnel engaging in night duties requiring a high degree of night visual

efficiency at starlight intensities should be provided with low-transmission sunglasses to be worn during any daytime activities which expose them to excessive sunlight.

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OBSERVATIONS ON THE VOSSIUS RING*

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Vossius ring is the eponymic term for a well-known ring occasionally seen on the anterior capsule of the crystalline lens of only young individuals, following trauma. Various writers have used other terms for it, usually to indicate its cause or appearance; such as, contusion ring, traumatic annular opacity, ring deposit.

Vossius first described this now-famous ring in 1903 and made a more comprehensive report on the subject before the International Congress of Ophthalmology, at Lisbon, in 1906. He distinguished two forms, a colored one which he said came from the pars ciliaris iridis, and a colorless one which he attributed to degenerative changes in the lens-capsule epithelium and possibly in the anterior cortical layers of the lens. The latter, he said, was more rare than the former.[†] Vossius ascribed the ring to an opacity in the capsule and possibly in the underlying anterior cortex of the lens, presumably caused by the impact of the iris against these tissues. Even in his last paper on this subject, in 1908, he held the same opinion.

The original theory of Vossius implied that the cornea was actually indented so that its posterior surface came in direct contact with, and forced the iris border against, the lens. The possibility that this could happen was promptly denied by many observers. Hoeg (1909) contested it on four grounds: the ring was almost

always complete, it was regular in form, the inner border was no denser than the outer, and, finally, the object causing the contusion would need to be of about the same size in all cases. He therefore suggested that a momentary rise in ocular pressure was sufficient to effect the same result. Steiner (1910) and shortly thereafter Purtscher (1913) described cases in which the injury had been *vis a tergo*, that is, by penetrating wounds of the posterior orbit. The corneas had suffered no direct trauma whatever. Few writers held to the old Vossius explanation after Hoeg's objections. Notable among them were Klauber (1918), Behman (1920), and Urbanek (1923).

Not until 1918 did Hesse and, shortly thereafter, Vogt show that the ring was not an opacity in the lens or lens capsule, but a thin ring of deposit on the former.

Severe trauma and intraocular hemorrhage are the two most constant factors. Vogt states that a Vossius ring has never followed nontraumatic hyphemia, and he believes the instance which Hesse reported, wherein a ring followed a vitreous hemorrhage twice punctured surgically, to be an "iritis ring."[‡] Hesse, who believes that the hemorrhage is more important than the trauma, brings forth the following evidence to support his views. He cites two cases in which the ring was seen following anterior-chamber hemorrhage, in which the trauma was insignificant; also Zentmayer's case, confirmed by

* From the Surgical Consultants' Division, Ophthalmology Branch, Office of the Surgeon General. Read before the eighty-first annual meeting of the American Ophthalmological Society, at Hot Springs, Virginia, November, 1945.

[†] Although I have never seen the colorless transparent form, E. Cramer gives an excellent example of one.

[‡] In his "Atlas of slit-lamp microscopy" he illustrates the difference, pointing out that the iritis ring is broader, its individual dots larger and more irregular in size, and also that free pigment dots appear on the capsule about the periphery of the ring.

Holloway, wherein a ring appeared after an anterior-chamber hemorrhage which followed an advancement operation. The iridic vessels were inadvertently injured by the needle penetrating, or possibly perforating, the sclera.

The period of time between the contusion and the appearance of the ring would seem to answer the question as to whether it was composed of iridic elements left behind on the lens when the two tissues were forcibly compressed against each other, or whether the ring was blood corpuscles or other blood elements secondarily deposited from intraocular blood, especially blood from the anterior chamber. The fact that no one has ever reported seeing a ring immediately after injury seems to prove there was none to observe. The shortest interval between the injury and discovery of a ring was two hours (Urbanek's case). In the great majority of cases the ring was not discovered until approximately four days after injury. It is claimed that delay in discovery is due to hindrances to examination—often the injury is immediately followed by bleeding in the anterior chamber or clouding of the cornea, either of which may obscure the picture. Or, more often, pain, irritation, and swelling of the lids make an accurate examination impossible. These reasons could account for the interval before discovery in most cases, but not all. If trauma were the direct cause, there would be at least a few cases in which the ring was observed immediately.

No instance of a ring has been observed in the absence of visible intraocular blood, or where the possibility of pre-existing intraocular blood has been excluded. Hesse is doubtless the first and strongest exponent of the hematogenous theory of origin. He points out that in certain instances a complete disc is deposited over the anterior lens capsule, the

center of which first becomes absorbed, hence leaving a ring. Caspar previously described such a case, wherein only after the coagulum overlying the capsule had become absorbed, did the complete ring appear. Peters, too, contends that the deposit is blood pigment rather than iridic pigment. He furthermore draws an analogy between it and hematogenous pigmentation of the cornea, and finds a similarity between the fine brown granules in the Vossius ring and the "fibrin crystals" which Leber described in the hematogenously pigmented cornea. The relatively short period of time occurring between the contusion and the appearance of the ring is the strongest argument against the similarity of these two deposits.

Exactly how a sudden rise in ocular pressure could cause pigmented particles from the iris to become fastened to the smooth lens capsule is not clear. Presumably, the rise in hydrostatic pressure in some manner would squeeze the iris tissue with sufficient force to cause interstitial fluids containing pigment granules and protein to leave the iris and become fastened to the capsule by fibrin. This is the so-called "abklatsch theory" which has the greatest number of supporters, notably Vogt, A. Jess, and others. A supplement to this idea was proposed by O'Asaro Biondo, who suggested that the lack of hydrostatic equality between lens and iris was an important factor. The inertia of lens being greater than that of iris caused sudden contact between them when the pressure wave traveled through the ocular media.

Handmann contributed a notable paper on Vossius rings in 1930, and carefully reviewed the literature to that date. He strongly supported the hematogenous theory of origin, but denied that contusion was invariably necessary. He likewise pointed out the similarity in size of

the rings which he had seen and those previously reported in the literature. On the basis of these observations he denied that the iris had anything to do with the pathogenesis and proposed a new theory of origin. He cited the detailed work of Busacca and Melli on the anatomy of the lens capsule; especially that the zonular lamellae, after fanning out over the equatorial surface, completely disappeared in just the area occupied and enclosed by the Vossius ring. Presumably, according to Handmann, the osmotic interchange of metabolites occurs in this area, where the capsule is devoid of one membranous layer, and it was not surprising to him that blood derivatives became fixed to the capsule, and indeed in the capsular pores at this point. The fact that the senile lens is immune to this process was explained by its decreased porosity. Handmann further speculated on the effect of the temporary stoppage or slowing down of the aqueous convection currents which often follow trauma. His interpretation was that the stagnation favored the deposition of blood or blood pigments on the capsule. Questions which were left without answer were, why Vossius ring so rarely, if ever, follows non-traumatic hyphemia; why it is always seen in its regressive and never in its formative stage; and what effect contusion has in initiating the process?

A single histologic examination might prove whether the particles deposited on the lens capsule were fuchsin bodies from the pupillary pigment epithelium or blood elements, but not to my knowledge has such an examination ever been made.

My interest in this subject was first stimulated when I observed that four soldiers, simultaneously in the hospital for contusions and penetrating wounds of the orbit, had Vossius rings of the same size. This seemed particularly interesting since their injuries had occurred

during the day, in two instances, and in the other two instances, during the night. The imprint of the pupillary margin on the anterior lens capsule should occur instantaneously at the moment of contusion and hence record either a contracted or dilated pupil. As more Vossius rings were seen in new patients, this uniformity in size was confirmed in every one. It first seemed possible that the pupil might have contracted following the light-flash stimulation, before contusion occurred, but since this pupillary light reflex is slow—0.2 to 0.5 seconds—and the blast wave very fast—12,000 ft. per second—it was obvious that this could not have happened. Even shell fragments which scatter at 6,000 ft. per second, striking the eye, would precede the pupillary reflex. Another pupillary reflex, that due to direct pressure on the globe, may also be considered here. Von Berlin and Gaille have described it, but to my knowledge its speed has not been measured.

PERSONAL OBSERVATIONS

During 10 months, 19 Vossius rings were seen in 15 patients; that is, four of these had bilateral rings. They all occurred in young American soldiers 19 to 30 years of age. All had been wounded in battle, six by mines, eight by shell or grenade fragments, and one by a rifle bullet. Contusion of the globe without perforation accounted for 13. Eight of these had multiple penetrating wounds of the cornea with retained foreign bodies in addition to contusion. There were three patients with intraocular foreign bodies; two had been removed before the Vossius ring was seen, and the third had multiple foreign bodies visible on the iris.

Intraocular hemorrhage was present in every eye. Thirteen showed blood in the vitreous. Except for the last two patients listed, who had massive vitreous hemorrhages and who had had intraocular

foreign bodies extracted by the posterior route, the vitreous hemorrhages were localized and circumscribed near the retina and usually in the far periphery. Hyphemia was seen in only two eyes, but

A transparent millimeter ruler was held as closely to the cornea as possible without actually touching it. The diameter was then measured as seen through a convex lens of an ophthalmoscope (+8.00D. sph.)

TABLE 1
DATA ON THE OCCURRENCE OF VOSSIUS RING IN 19 EYES OF 15 SOLDIERS

Case No.	Age	Hour Injured	Diameter of Vossius Ring	Cause	Nature of Eye Injury	Vision	Tension (Schigtz)	Days Between Injury and Vossius Ring
1	20	2300	R. — L. 2.50	Bullet	R. Avulsion L. Contusion-vit. & ret. hem.	R. nil L. 1/200	— —	4
2	29	1350	R. 2.50 L. —	Mine	R. Contusion-vit. & ret. hem. L. Perf. wd., iridodial., bull. ker.	R. 20/30 L. 2/200	— —	5
3	30		R. 2.25 L. —	Shell	R. Pen. wds.—F.B.'s, vit. & ret. hem. L. Perf. wd., phthisis bulbi	R. 4/200 L. L.	— —	19
4	19	0100	R. 2.50 L. 2.50	Mine	R. Pen. wds.—F.B.'s L. Pen. wds.—F.B.'s, vit. hem.	R. 20/50 L. 20/50	— —	3
5	20	1400	R. — L. 2.50	Shell	R. None L. Contusion-vit. & ret. hem., hole macula	R. 20/20 L. 25/00	R. 13 L. 8	4
6	19	1300	R. 2.75 L. —	Shell	R. Contusion-vit. hem. L. None	R. 20/70 L. 20/30	R. 13 L. 13	4
7		0200	R. — L. 2.00	Mine	R. Pen. wds.—cor.—F.B.'s L. Perf. wds.—i.o.F.B.'s.—iris-vit. & ret. hem.	R. 20/30 L. 20/40	R. 9 L. 8	8
8	20	1730	R. 2.50 L. —	Shell	R. Contusion-bull. ker-vit. hem. L. None	R. 20/400 L. 20/20	— —	4
9	22	1030	R. 2.50 L. 2.60	Mine	R. Contusion-hyphemia, vit. hem.—F.B.'s L. Pen. wds.—cornea-contusion-few aq. cells	R. 20/100 L. 20/50	R. 11 L. 10	3
10	20	0600	R. 2.75 L. —	Mine	R. Contusion-large orb.—F.B.—i.o.F.B. L. None	R. 20/900 L. —	— —	— —
11	21	0300	R. 2.25 L. —	Grenade	R. Contusion-hyphemia-ret. & vit. hem. L. None	R. 20/200 L. 20/70	— —	4
12	25	0400	R. 2.60 L. 2.50	Mine	R. Contusion-pen. wds. & F.B.'s.—cells in a.c. L. Contusion-pen. wds. cor. & F.B.'s.—cells in a.c.	R. 20/50 L. 20/70	R. 15 L. 18	4
13		1430	R. 2.50 L. 2.50	Shell	R. Contusion-rupture iris-sphincter-pen. wds. with F.B.'s cor.—vit. hem. L. Contusion-pen. wds. cor.—F.B.'s.	R. — L. —	— —	17
14	23	1130	R. 2.50 L. —	Grenade	R. Perf. wd.—i.o.F.B. (large), vit. hem. after F.B. extraction L. None	R. L.P. L. —	— —	25
15	20	1700	R. 2.60 L. —	Shell	R. Perf. wd. & i.o.F.B. post. extraction L. None	R. L.P. L. —	— —	12

was doubtless present in many others before the patients came to the hospital. In only four eyes was it impossible to find extensive retinal or vitreous hemorrhage. These eyes did have cellular elements visible in the aqueous on slitlamp examination, doubtless blood cells.

The size of 19 contusion rings varied between 2.25 and 2.75 mm. as measured by the following relatively crude method:

without making any correction for its magnification by the cornea. The width of the band forming the ring could not be measured by this method. On correlating this uniform diameter of the ring with the size of the pupil at the time of injury, the following analysis is interesting: Eight injuries occurred during daylight hours, five during darkness, and one at twilight. It is therefore clear that the size of the

Vossius ring bears no relation to the size of the pupil before injury occurred.

Certain other physical characteristics of the ring are worthy of mention, and one in particular constitutes strong evidence against the theory that it is an impression of the pupillary margin on the anterior lens capsule. The ring is composed of fine brown dots arranged in an evenly distributed pattern. Its outer border is perfectly smooth, but its inner border, which is the nearer to the smooth free iris border, is distinctly irregular. Groups or clusters of particles extend toward the center of the pupil in a manner which gives this margin a scalloped or even saw-toothed appearance with the slitlamp. If the Vossius ring were an imprint of the pupillary margin, one would expect that the inner border of the imprint, corresponding to the free iris margin, would be smooth, whereas the outer might or might not be. That the reverse is true is additional strong evidence that the iris margin is not imprinted on the lens capsule. The smooth outer border is more likely to be so delimited for some other reason; such as, an abrupt anatomic change in the lens capsule at the equatorial region.

OBSERVATIONS ON CONDITIONS ALLIED TO VOSSIUS RING

It is desired at this time to draw attention to a condition I have observed in two patients which I believe is pathogenically related to the Vossius-ring phenomenon.

The first patient was a soldier, aged 20 years, with sympathetic uveitis. He was first seen by me 11 weeks after a shell fragment had perforated his left eye and 5 weeks after the onset of uveitis in his right eye. His right eye had been atropinized since he first noticed blurring of vision, and the pupil had been well dilated at all times. Vision was 20/50. The

injured eye had been removed two weeks after sympathetic ophthalmia began, and on pathologic examination showed inflammation consistent with sympathetic uveitis. The sympathizing eye was slightly congested. There were keratitic precipitates covering almost the entire posterior surface of the cornea, increasing in number and size over the lower half in characteristic fashion. Similar precipitates also covered the anterior lens capsule. These were generally more uniform in size and distribution than those on the cornea. The important observation was that within a perfect circle, measuring 2.75 mm. in diameter on the center of the anterior lens capsule, there was a distinct area of clearing of the precipitates. Although not absent altogether, they were smaller in size and more sparsely distributed. The clear disc was best seen when viewed through the ophthalmoscope.

The patient was again seen nine weeks later. The disc of clearing was still perfectly obvious, although less well demarcated.

When observed through the slitlamp, this particular portion of the lens capsule appeared to be covered with a delicate, lacelike film with knots comprising the precipitates. The latter were not invariably joined together but usually had several spicules extending toward their neighbors. No spicules extended into the anterior chamber. The precipitates themselves were gray and faintly pigmented. There were many fine cellular elements circulating in the aqueous, but no Koeppe nodules could be seen on the iris margin.

Since describing this finding to Dr. David G. Cogan, four months ago, he has told me that he too has observed this clear disc on the anterior lens capsule of a patient with chronic uveitis. Although its actual diameter was not meas-

ured, he, in retrospect, estimated it to be about 2 to 3 mm.

DISCUSSION

As can be seen in the foregoing narrative about Vossius rings, much has been written about them. These writings are found almost entirely in the foreign literature. The subject as a whole does not seem to have stimulated much interest either in America or in England. In fact, I have yet to find an American ophthalmologist who has entertained any other theory of origin than that originally proposed by Vossius.

Although there is still much to be learned about the conditions, it seems wise at this time to assemble the knowledge gained from the important contributions cited, add to them observations which I myself have made, and finally sort out the factual from the fanciful ones.

The following facts seem clearly established:

Vossius ring is almost without exception the result of trauma. Zentmayer's patient, who certainly had a minimal amount of trauma, did have a tiny perforating wound and in addition the surgical trauma attending any advancement operation. Hesse, who has been the strongest exponent of the hematogenous theory of origin, stresses the importance of intraocular blood, at the same time minimizing the importance of trauma. In two of his cases he mentions that they had no "significant" trauma but does not say they had none whatever. I believe, therefore, that the existence of a nontraumatic Vossius ring has never been proved.

Intraocular hemorrhage is also a wholly constant finding. It was present in each of my 19 cases and in no reported case has its presence been excluded. Blood

may be found either in the retina, vitreous, or aqueous. Often it is found in two or all three of these structures. That intraocular hemorrhage is such a constant factor is strong presumptive evidence that it plays an etiologic role.

Senile and presenile eyes seem to be immune to Vossius-ring formation. So far as I know, a ring has never been recorded in the eye of a patient after the beginning of the fifth decade.

Vossius rings have been seen only in the regressive and never in the formative stage. This is a significant fact, and until the formative stage has been observed it constitutes the weakest link in the hematogenous theory of origin and a strong argument for the "abklatsch theory." In my opinion it is likely that some day a ring will be seen to form, since other evidence points so strongly to the idea that they are composed of blood pigments. The fact that they have not to this day been observed in their developmental stage may be explained by their rarity, the difficulty in adequately examining a freshly injured eye, the fact that hyphemia so often obscures the lens capsule and, probably more important, that they escape our notice until completely formed. We see only that for which we are searching.

Vossius rings have never been observed immediately after injury. As previously mentioned, two hours is the earliest interval between injury and observation. This time interval does not exclude the possibility that iridic pigment may have been deposited at the time of contusion, but it is evidence against it. If the ring be of blood pigments; or blood derivatives, two hours seems an incredibly short period of time for them to be deposited. However, the vast majority are seen days after injury, and since errors in observation are always

possible, the common prolonged latent period is probably more significant.

The constant size of Vossius rings has now been established. In the 19 cases reported, the variations in diameter did not exceed one-half millimeter, and in every reported case, where measurements have been recorded, the size is practically identical with those I have reported. As previously pointed out, this in itself practically excludes the possibility that the iris margin has left its imprint on the lens capsule.

Finally, a characteristic which I believe is constant is the smoothness of the outer border and irregularity of the inner border of the Vossius ring. This is further strong evidence against the "abklatsch theory" of origin.

The following questions remain without answer or are purely in the realm of speculation: If the ring is not caused by an impression of the iris margin, what is its cause? What are the fine brown granular deposits which one sees with the slitlamp? Why is the ring of constant size? Why is trauma a necessary factor, or why does the ring never follow nontraumatic hyphemia? Finally the question arises—What is the relationship between the Vossius ring and the disc of clearing which I have described in uveitis?

Handmann has thrown considerable light on these questions. Since the lens capsule loses its zonular lamella somewhere in this region, one might assume that it occurred exactly at the outer margin of the Vossius ring. This would account for its regular size, and since the theory accepts the hematogenous origin, it would follow that the brown deposits are blood pigments. The greater interchange of fluids between aqueous and lens through this thinner area of the capsule

reasonably explains the deposition of a disc of blood pigment within this circle. It seems to me it also explains the relative clearing of these and other deposits in the central area. But the fact that a ring is the rule and a disc is the exception, cannot be satisfactorily explained with our present knowledge. It may be that the circulation in the anterior chamber is temporarily abolished as suggested by Handmann, but this must also occur in some cases of spontaneous hemorrhage. In my opinion trauma must have some other effect. An explanation of this important point awaits further elucidation.

CONCLUSIONS

1. Nineteen cases of Vossius-ring formation are reported.

2. All occurred as a result of battle injury in American soldiers between the ages of 19 and 30 years.

3. Intraocular hemorrhage was found in every eye.

4. The size of the ring was practically constant in all cases—2.25 to 2.75 mm. were the limits of variation in their diameters.

5. It is concluded that the ring does not consist of iris pigment left behind on the lens capsule as a result of the injury.

6. The most tenable explanation for the formation of the Vossius ring is that blood pigments from the aqueous are deposited in characteristic fashion during the interchange of fluids through the anterior lens capsule.

7. A disc of clearing is described on the anterior lens capsule in a case of uveitis. This is thought to indicate that interchange of fluids through the anterior lens capsule takes place chiefly here.

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SACCULAR PROLAPSE OF THE VITREOUS BODY*

REPORT OF CASE

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Hernias of the vitreous body into the anterior chamber of the eye may be classified into three groups according to Paula-Santos:¹ (1) hernias following intracapsular extraction of cataracts; (2) hernias following the rupture of the vitreous body after discission of the lens or an aftercataract; and (3) hernias following displacement of the lens into the anterior chamber. In the first group the vitreous body remains intact and the hernia usually occurs as a symmetrical protrusion into the anterior chamber. After several days the hernia may recede to normal position. In the third group hernias occur after rupture or partial disinsertion of the zonule. This group includes congenital, surgical, and traumatic displacements of the lens.

Hernias resulting from traumatic displacement of the lens may have two distinct forms: (1) no definite anterior limiting membrane; (2) a distinct anterior limiting membrane covering the vitreous which is in the form of a sac or a

drop. This saccular form is extremely rare. Blood may be placed in the dependent portion of the sac and almost without exception pigment is deposited on the anterior limiting membrane in a kaleidoscopic fashion. The anterior limiting membrane may appear as a single layer or it may appear to be laminated. Duke-Elder² stated that this distinct anterior membrane is probably a mechanical effect of the tension and stress created by the prolapse on the micellar structure of the vitreous causing a rearrangement, a re-orientation, and a condensation of its fibrillar contents. Cowan and Fry³ offered anatomic and histologic evidence that a hyaloid membrane existed as a nonnuclear, structureless, uniformly staining membrane. This membrane was attached to the pars plana of the ciliary body and separated the aqueous from the vitreous chamber. Previously Cowan⁴ stated that the membrane might be a proliferation of the vitreous surface but not a condensation.

REPORT OF CASE

The patient, a white man, came to the

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Mayo Clinic on July 2, 1945. The right eye had been injured by a football in 1918, at which time he had partial loss of vision. In 1929 he noticed that the right eye was divergent and that its vision was limited to perception of moving objects. On June 9, 1945, the right eye became extremely painful and red. He consulted an ophthalmologist and was informed that a cataractous lens was dislocated into the anterior chamber and was causing irritation. He was given atropine to use twice daily. The eye remained red but the pain gradually subsided. However, on June 27th, the eye again became extremely painful. His physician, at this time, advised an operation to reduce the intraocular pressure. He consulted another ophthalmologist shortly thereafter and was told the pressure was normal.

Examination at the Clinic revealed visual acuity of 1/60 in the right eye and 6/6 in the left eye. The right eye was 30 degrees divergent. Pupillary reflexes were absent in the right eye but were prompt in the left eye. Further examination of the left eye revealed no abnormalities, so the following comments pertain only to the right eye. The eye was free from inflammation except slight circumcorneal injection. The iris was tremulous and remnants of the lens capsule were discernible in the anterior chamber. The fundus was seen poorly but appeared normal. Biomicroscopy revealed that the cornea was clear, the anterior chamber deep, and the pupil 4 mm. in diameter. Saccular herniation of the vitreous had occurred through the pupil. The vitreous was confined by an intact anterior limiting membrane which could be outlined clearly. There were numerous deposits of pigment on the surface of the limiting membrane. Remnants of the lens capsule were firmly attached to its anterior surface. The vitreous gel posterior to the anterior limiting

membrane was optically clear. There was practically no aqueous in the anterior chamber. Intraocular pressure was 25 mm. Hg (Schiotz) in the right eye, and 22 mm. in the left eye. Tension on July 9, 1945, was 45 mm. Hg in the right eye. The acute glaucoma was probably due to the nearly complete filling of the anterior chamber by the intact herniated vitreous which partially obstructed the filtration angle.

The patient was given miotics and operation was advised to reduce the tension and to clear the pupil of opacities for vision. On July 12, 1945, a small incision was made at the upper limbus with a keratome. The vitreous immediately presented at the incision and was removed. Capsular remnants of the lens attached to the anterior limiting membrane of the vitreous were removed with forceps.

The patient made an uneventful recovery. Refraction on July 25, 1945, revealed that with +10.50D. sph. \approx +2.75D. cyl. ax. 125°, the visual acuity was 6/7. With the addition of a +3.0 sphere, his visual acuity was 14/21, according to the American Medical Association reading chart.

COMMENT

Traumatic herniation of the vitreous body into the anterior chamber is rare.^{1, 5, 6, 7} It is easily recognized by the biomicroscopic examination.^{8, 9} Whether or not blood was present in the dependent portion of the sac in this case would only be conjectural. However, the many scattered deposits of pigment on the anterior limiting membrane may have been the result of hemorrhage.

The anterior limiting membrane in this case was probably a new formation. Paula-Santos¹ called attention to the fact that if the hyaloid membrane is not broken, it must be quite elastic to permit

the vitreous to protrude through the pupil. Then by virtue of its own elasticity it should assume its original position and thereby reduce the herniation. It is more reasonable to assume the formation of a new membrane resulting from a physiochemical response between the vitreous and the aqueous humor rather than a

stretching of the hyaloid. It cannot be satisfactorily demonstrated anatomically; moreover, Duke-Elder¹⁰ has shown that the entire vitreous body will pass through a filter paper leaving behind no residue except a homogeneous protein material which is not derived from the surface of the vitreous.

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CYCLODIALYSIS IN THE TREATMENT OF GLAUCOMA*

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Cyclodialysis was described by Heine in 1905 as a procedure for the surgical treatment of chronic primary glaucoma.¹ Since then it has been used in the treatment of all recognized types of the disease. It is the purpose of this paper to report the results in 140 cases when cyclodialysis was performed. These cases may be divided into three categories: (1) chronic primary glaucoma, (2) glaucoma following cataract extraction, and (3) glaucoma secondary to active uveitis.

MATERIAL

This report is based on the case histories of patients with these three types of

TABLE 1

RESULTS OF CYCLODIALYSIS IN CHRONIC PRIMARY GLAUCOMA, GLAUCOMA FOLLOWING CATARACT EXTRACTION, AND GLAUCOMA SECONDARY TO UVEITIS

Type of Glaucoma	Cases Followed One Year	Cases with Tension Less Than 30 mm. Hg (Schiotz)	Percentage
Chronic primary	45	19	42
Following cataract extraction	39	14	35.9
Secondary to uveitis	31	2	6.5

glaucoma in whom cyclodialysis was performed in the Wilmer Institute between January 1, 1927, and January 1, 1944. In determining the final results in the three types of glaucoma, the classification "success" was used only in those histories with follow-up periods of one year or more; the definition of "success" being

that the tension was controlled within normal limits for a minimum period of one year. On the other hand, for the classification "failures," all case histories were used in which there was any record of consistently or repeatedly elevated tension after the operation, irrespective of the period of observation. In all cases the tension was taken with a Schiotz tonometer, and any tension over 29 mm. Hg was considered elevated. Operations in all cases were performed by members of the resident or full-time staff of the Wilmer Institute.

RESULTS

The results in these three types of glaucoma are given in table 1.

Chronic primary glaucoma. Cyclodialysis was performed in 56 eyes with chronic primary glaucoma. In 12 of these cases, cyclodialysis was performed as the initial procedure. In 9, it was a second operation following an unsuccessful iridencleisis, in 15 it similarly followed an unsuccessful trephining, and in 20 cases, it followed two or more previously unsuccessful operations for glaucoma. Forty-five of these cases were followed for at least one year. In 19 cases (or 42 percent) the cyclodialysis was successful, and the patient maintained a normal intraocular pressure for the year (see table 1). Only one of these 19 successful cases subsequently developed an increase of tension greater than 30 mm., the duration of follow up in this case being 2½ years.

In table 2 these cases are classified according to the depth of the anterior chamber. Thus the operation was performed in 16 eyes with deep anterior chambers, of which 14 were followed for one year or more; 10 (or 71 percent)

* From the Wilmer Ophthalmological Institute of the Johns Hopkins Hospital and University.

maintained a normal intraocular pressure at the end of the period of observation. Cyclodialysis was performed in 18 eyes with shallow anterior chambers, 12 of which were followed for one year or more. Only five (or 42 percent) had a normal tension at the end of the period of observation. This difference, although not statistically significant, suggests that cyclodialysis may be more effective in eyes with deep than in eyes with shallow anterior chambers.

In the total of 56 cases of chronic primary glaucoma which are here analyzed, the operation in 27 cases was a failure in that the intraocular pressure was not maintained within normal limits for a period of one year. In 14 (or 52 percent) of these, the failure was evident in the first 14 postoperative days, and in 21 (or 78 percent) it was evident in the first postoperative month. At the end of the first postoperative year, 26 (or 96 percent) of the failures had occurred. This suggests that if the operation is not suc-

TABLE 2

EFFECT OF DEPTH OF ANTERIOR CHAMBER IN CHRONIC PRIMARY GLAUCOMA

Anterior Chamber	Cases Followed One Year	Cases with Tension Less Than 30 mm. Hg (Schiotz)	Per-centage
Deep	14	10	71
Shallow	12	5	42

cessful, the failure usually becomes apparent soon after the operation.

Glaucoma following cataract extraction. Cyclodialysis was performed in 53 eyes with glaucoma following cataract extraction, and 39 were followed for a minimum of one year. In 14 of these eyes (or 35.9 percent) the operation was successful in that the tension was still normal at

the end of one year, although in two cases, followed 2½ years, the tension later rose.

In 33 of these eyes cyclodialysis was performed as the initial procedure, and 26 of these 33 eyes were followed at least one year; 10 (or 38.5 percent) maintained a normal intraocular pressure during this period. In 20 additional eyes, cy-

TABLE 3

EFFECT OF DEPTH OF ANTERIOR CHAMBER IN GLAUCOMA FOLLOWING CATARACT EXTRACTION

Anterior Chamber	Cases Followed One Year	Cases with Tension Less Than 30 mm. Hg (Schiotz)	Per-centage
Deep	19	9	47
Shallow	15	4	27

clodialysis was performed as a second operation, the eyes having had at least one previous operation for the glaucoma. Thirteen of these eyes were followed for at least one year. In 4 (or 30.8 percent) the cyclodialysis was successful, and the eyes had a normal tension at the end of this time. This similarity of results suggests that the presence or absence of previous operative procedures may have little effect on the success of cyclodialysis.

These cases are also analyzed according to the depth of the anterior chamber (table 3). Twenty-four of the patients had deep anterior chambers, and of these, 19 were followed for at least one year. At the end of this time, 9 (or 47 percent) still had a normal tension. Twenty-two of the eyes had shallow anterior chambers, and of these 15 were observed for at least one year. At the end of that time, only 4 (or 27 percent) still maintained a normal intraocular pressure. This suggests that cyclodialysis may be more successful in

aphakic eyes with deep anterior chambers than in those with shallow ones.

There were 27 failures in the 53 eyes of this series. Ten (or 37 percent) of these failures were evident in the first 14 postoperative days, and 15 (or 55.5 percent) in the first month. By the sixth postoperative month, 25 (or 92.6 percent) of all failures had occurred. This again suggests that failure of cyclodialysis to maintain normal intraocular pressure is most likely to occur in the first six postoperative months, and that if in-

TABLE 4
INCIDENCE OF COMPLICATIONS

Complication	Eyes Operated on	Number of Complications	Percentage
Anterior-chamber hemorrhage	140	87	62.1
Vitreous hemorrhage	140	8	5.7
Laceration of Descemet's membrane	140	7	5
Hypotonia	140	3	2.1

traocular pressure is maintained at a level of less than 30 mm. Hg for this period of time, it is unlikely to rise at a later date.

In 11 cases of these 27 failures, a second cyclodialysis was done without another intervening operative procedure. In 4 of these (or 36.3 percent), the follow-up period varying from three months to three years following the last operation, the tension was successfully controlled. In the remaining seven eyes, the second operation likewise was a failure.

Glaucoma secondary to active uveitis. Cyclodialysis was performed in 31 eyes with glaucoma secondary to active uveitis, and all were observed for at least one year. In 16 of these eyes, the cyclodialysis was obviously unsuccessful within the

first 14 postoperative days, whereas in 15, the tension was still normal. At the end of the first postoperative month, eight of these 15 eyes still had a normal tension, and this was maintained in six at the end of three months. However, at the end of one year only two of these (or 6.5 percent of the original cases) had a tension less than 30 mm., whereas 29 (or 93.5 percent) had an intraocular pressure of more than 30 mm. Hg (Schiotz). Each one of these 29 cases subsequently required another operative procedure for the persisting glaucoma. This strongly suggests that cyclodialysis is not effective as a procedure to give any lasting control of glaucoma secondary to uveitis.

COMPLICATIONS

The most frequent early complications of cyclodialysis were anterior-chamber hemorrhage and vitreous hemorrhage. Anterior-chamber hemorrhage occurred in 87 of 140 eyes operated on, an incidence of 62.1 percent (table 4). There was little difference in the incidence in the three types of glaucoma involved. Hemorrhage usually occurred at the time of operation (52.9 percent), but was occasionally seen first at the time of the first dressing (6.5 percent). In the later postoperative course, hemorrhage was uncommon, being present in only three eyes (2.1 percent).

Fifty-six cases of chronic primary glaucoma and 53 cases of glaucoma following cataract extraction were analyzed according to the severity of anterior-chamber hemorrhage (tables 5 and 6). Of the 56 eyes with chronic primary glaucoma, 36 eyes had either no hemorrhage or one occupying less than one fourth of the anterior chamber. Twenty-eight of those eyes were followed for at least one year. At the end of that time 15 (or 54 percent) had a normal tension. Twenty eyes were observed with hemorrhages oc-

cupying more than one fourth of the anterior chamber. Sixteen of these were followed for at least one year, and in only 4 (or 25 percent) was a normal tension present at the end of this period. This suggests that hemorrhage occupying more than one fourth of the anterior chamber may predispose to failure of the operation. The same holds true in aphakic eyes. Of the 53 cases in this group, 40 had either no anterior-chamber hemorrhage or one occupying less than one fourth of the chamber. Twenty-eight of these cases were observed for at least one year, and at the end of that time, in 12 (or 43 percent) the operation was successful. In 13 cases hemorrhages occupied more than one fourth of the anterior chamber, and of 11 cases followed at least one year, only 2 (or 18 percent) maintained a normal tension. In one case, the anterior-

eyes was there any final reduction of vision attributable to the hemorrhage.

Two late complications of cyclodialysis encountered in this series were hypotonia and lacerations of Descemet's membrane. Hypotonia occurred in three of 140 eyes

TABLE 6

EFFECT OF ANTERIOR-CHAMBER HEMORRHAGE ON THE CONTROL OF GLAUCOMA FOLLOWING CATARACT EXTRACTION

Amount of Hemorrhage	Cases Followed One Year	Cases with Tension Less Than 30 mm. Hg (Schiotz)	Percentage
None, or less than one fourth of anterior chamber	28	12	43
One fourth or more of anterior chamber	11	2	18

TABLE 5

EFFECT OF ANTERIOR-CHAMBER HEMORRHAGE ON THE CONTROL OF CHRONIC PRIMARY GLAUCOMA

Amount of Hemorrhage	Cases Followed One Year	Cases with Tension Less Than 30 mm. Hg (Schiotz)	Percentage
None, or less than one fourth of anterior chamber	28	15	54
One fourth or more of anterior chamber	16	4	25

chamber hemorrhage resulted in occlusion of the pupil.

Vitreous hemorrhage occurred in 2 of 56 eyes with chronic primary glaucoma, in 6 of 53 eyes with glaucoma following cataract extraction, and not at all in 31 eyes with glaucoma secondary to uveitis. This represents an over-all incidence of 5.7 percent. In only one of these eight

operated on, an incidence of 2.1 percent, but in no instance resulted in a decrease of final visual acuity. Lacerations of Descemet's membrane occurred in seven of 140 eyes operated on, an incidence of 5 percent, but again in no case did it result in a reduction of final visual acuity.

DISCUSSION

A survey of the literature reveals varied reports of the final results obtained following cyclodialysis. These range from 28 percent reported by Meissner and Sattler² to 77.8 percent reported by Gradle.³ The latter's results were obtained in cases of chronic simple glaucoma with no inflammatory reaction. Comparable results were obtained in this series in a group of cases similar to Gradle's, those with chronic primary glaucoma and deep anterior chambers. Spaeth reports cyclodialysis to be successful in 45 to 50 percent of cases.⁴ His series included, in addition

to cases of chronic primary glaucoma, cases of inflammatory glaucoma and those in which other operations for glaucoma had been performed. Similar results were obtained in the present series in that group of cases which included all types of chronic primary glaucoma. It seems that probably the best results would be obtained in primary glaucoma by adhering to Gradle's dictum and performing cyclodialysis only in chronic simple glaucoma without inflammatory reaction.⁵

The widely accepted belief that cyclodialysis is a harmless procedure is given further proof in this series; for, in spite of an incidence of anterior-chamber hemorrhage of 62.1 percent and of vitreous hemorrhage of 5.7 percent, only two of 140 eyes operated on showed any reduction of vision as a result of these complications. In addition, there was no instance of postoperative infection.

The low incidence of success in glaucoma secondary to active uveitis, the low incidence of success in eyes with shallow anterior chambers, and the poor results obtained after severe anterior-chamber hemorrhage point to some obstruction of the angle of the anterior chamber as the probable cause of failure of the procedure. If one accepts Barkan's conclusion that the establishment of a communication between the anterior chamber and the suprachoroidea is a mechanical *sine qua non* in the successful action of cyclodialysis, it is easy to understand the failure in these cases.⁶

Because of the relative frequency of anterior-chamber hemorrhage and its untoward effects on the prognosis following cyclodialysis, various procedures to prevent hemorrhage were made at operation. These include cauterization of episcleral vessels prior to scleral incision, pressure over the sclera during withdrawal of the spatula and for a short time thereafter, and the use of the Randolph spatula to ir-

rigate the chamber once hemorrhage has occurred. The relative efficacy of these measures was impossible to evaluate.

SUMMARY

The results of cyclodialysis in 140 eyes with chronic primary glaucoma, glaucoma following cataract extraction, and glaucoma secondary to uveitis are analyzed.

(1) Cyclodialysis resulted in an intraocular pressure of less than 30 mm. Hg (Schiotz) in 42 percent of 45 cases with chronic primary glaucoma, in 35.9 percent of 39 cases with glaucoma following cataract extraction, observed for one year, but only in 6.5 percent of cases of glaucoma secondary to active uveitis.

(2) Cyclodialysis was more effective in eyes with deep than with shallow anterior chambers in both chronic primary glaucoma and glaucoma following cataract extraction.

(3) Failure of cyclodialysis to maintain intraocular pressure at less than 30 mm. Hg (Schiotz) was most likely to be evident in the first postoperative month, 78 percent of the failures in chronic primary glaucoma, and 55.5 percent in glaucoma following cataract extraction being noted in this period. Practically all failures occurred in the first year; 96 percent of those in chronic primary glaucoma and 92.6 percent of those in glaucoma following cataract extraction.

(4) In glaucoma following cataract extraction, after the failure of one cyclodialysis to control tension, a second cyclodialysis was successful in 36.3 percent of 11 cases so treated.

(5) Anterior-chamber hemorrhage occurred in 62.1 percent of 140 eyes operated on. Hemorrhage occupying more than one fourth of the anterior chamber prejudiced the control of intraocular pressure in eyes with chronic primary glaucoma and in those with glaucoma follow-

ing cataract extraction, but smaller hemorrhages had no deleterious effect.

(6) Vitreous hemorrhage occurred in 8 of 140 eyes operated on, an incidence of 5.7 percent. In only one case was there a reduction of vision directly attributable

to the vitreous hemorrhage.

(7) Postoperative hypotonia was encountered in 2.1 percent of 140 cases and lacerations of Descemet's membrane in 5 percent. In no case did these result in a reduction of final visual acuity.

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UNAIDED VISUAL ACUITIES CORRELATED WITH REFRACTIVE ERRORS

A STUDY

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INTRODUCTION

With the passage of the Selective Service Act, in 1940, and especially after the attack on Pearl Harbor by the Japanese, many men and women, the volunteers as well as those who were called to serve their country, came to the Army Induction Stations and General Dispensaries for their physical examinations.

These centers were overtaxed with applicants. Complete and impartial physical examinations had to be conducted with the meager means at hand, and opinions had to be given regarding the fitness or unfitness of the individual for military duty. Sometimes these opinions were made hurriedly, sometimes under extreme pressure.

The ocular examinations came to be regarded as of great importance. Many applicants who desired to enter the military service tried to hide visual defects, either by not mentioning them or by attempt-

ing to evade their detection. A few who wished to evade military service entirely as well as those anxious to obtain a non-combatant classification exaggerated a known visual defect or stated that one existed.

It is pertinent to mention these two groups—negative and positive ocular malingerers—because the writer found that their existence created a very definite need for some systematized method of correlating the unaided visual acuity with the refractive error, provided the correcting lenses brought the visual acuity of the eyes to the accepted Snellen standard of 20/20, when no organic disease was present.

For example: If three individuals possessing correcting lenses of $-1.50D.$ sph. $\approx -1.00D.$ cyl. ax. 180° , which gave them normal vision, presented themselves for examination, and the unaided visual acuity of one was 20/200, of the sec-

ond 20/100, and of the third 20/300, an average uncorrected visual-acuity reading of 20/200 would be obtained. It would then be reasonable to expect an unaided visual-acuity reading in the vicinity of 20/200 from others who possessed correcting lenses of that power, provided no organic ocular lesion was present.

As has been stated, the unaided visual acuity of any group of persons who possess the same corrective power of lenses would vary. Numerous factors—such as age, fatigue, foci of infection, malnutrition, accommodative power—would cause such variations, but there would be a reasonable range of such variation.

A chart or charts containing the average unaided visual-acuity data and the visual ranges for each of the corrective lenses most commonly encountered would materially aid an examiner in the detection of malingerers, and in classification.

The opportunity for such study presented itself in two ways. The great majority of the men and women who came for the physical examination prior to induction to the service were applying as officer candidates. The general average-intelligence level of these people was somewhat above that of the average inductee, and their responses during the ocular examination were somewhat more reliable. This, however, does not exclude a considerable portion of this group from the two classes of ocular malingering mentioned previously. Secondly, when the Army began to issue spectacles to its personnel, requests for refractions increased by leaps and bounds. The officers and enlisted men presenting themselves for an ocular examination and refraction, as a whole, no longer had any reason to be positive or negative malingerers. Many came because they were told that they needed glasses; a number came because they thought that this was a good oppor-

tunity to have their spectacles changed; others, because they desired an ocular examination.

METHODS

The physical-examination records of 45,206 men and women as well as 7,482 refraction records were reviewed for this study. Since each square of the presented charts represents the unaided visual acuity of an eye that obtained standard vision with the corresponding correcting lens or lenses, all records that showed vision correctable to 20/20 in the absence of organic disease were retained for tabulation.

All of the examinations were performed at an Army General Dispensary. The author personally examined more than half of these individuals, and the remainder were examined by associates trained in his routine methods of examination.

Each examinee, whether present for a routine physical examination or for an ocular examination and refraction, was impressed with the fact that squinting would not be permitted.

The American Optical Company Projecto-Scope and Screen were used throughout these examinations. Visual acuities were tested at 20 feet from the screen. The unaided visual acuity of each eye as well as binocular vision was recorded. Individuals who had unaided visual acuity of less than 20/400 in one or both eyes, were slowly walked up to the 400 figure until it was accurately identified. The distance between the examinee and the screen was then recorded as the numerator and 400 as the denominator. No one chart or figure was used consistently. Four different Projecto-Scope charts were used interchangeably, so that no one could familiarize himself with nor memorize them.

Each eye was then examined for patho-

logic lesions and a notation made of any existing abnormality. Following this, the spectacles (if any) of the examinee were neutralized, and the vision of each eye, separately, and the binocular vision with the glasses were noted. If the vision in each eye was not corrected to 20/20, a rapid retinoscopic examination was performed with the aid of the trial-case frame and lenses. The best visual acuity obtained for each eye and the strength of the correcting lenses in the trial-case frame were recorded on the physical-examination sheet. Fundus studies were made on all whose vision in either eye was not correctable to 20/20; on all whose unaided visual acuity was 20/100 or worse; and on all who gave a history of ocular pathologic change.

All military personnel under the age of 40 years, with no contraindications noted, received a cycloplegic examination. The manifest refraction of those over 40 years was recorded. Fundus studies were made in every instance.

METHOD OF TABULATION

Fifty charts for each refractive group, exactly as those presented, were attached to a large board. The upper row represented the Hyperopic group, the middle row represented the Myopic group, and the lower row the Mixed-Astigmatism group.

As each record was reviewed, the refractive error was noted, and the square corresponding closest to that error was filled with the unaided visual acuity, and the age of the individual. As the squares of the lower refractive errors quickly filled the 50 charts of each group, additional charts were attached in order to include all such unaided visual acuities.

With the review of records completed, loose-leaf pages, each marked consecutively to correspond to the refractive errors, were made up in book form—one

book for each refractive group.

Each page had the refractive error, age groups, and axes arranged in the manner shown in table 1. The recorded unaided visual acuities were then transposed to the proper pages and inserted under the correct age-group and axes columns.

These columns were individually added, and the total divided by the number of figures in that column. This gave the average unaided visual acuity for that particular refractive error and age group. Immediately below each column the extremes of unaided visual acuity were recorded and enclosed in parentheses.

Since the average unaided visual-acuity figures are impracticable for use by the average examiner, the writer converted them to the nearest Snellen equivalent.

For example: In table 1 the average unaided visual acuities are: 35, 32, 38, 37, 44, 41, 52, 50, 52, 49, 61, 57. When converted to the nearest Snellen equivalent they become: 30, 30, 40, 40, 40, 40, 50, 50, 50, 60, 60, 60.

RESULTS

Table 2 represents the average unaided visual-acuity findings of eyes, with no organic pathologic lesions which are correctable to 20/20 by the corresponding lens corrections in the three main refractive-error groups.

The great majority of the unaided visual-acuity readings are accounted for in the triangular region of 0 to 4.00D. spheres and 0 to 3.00D. cylinders, singly, and in combination, in all refractive groups. Myopic corrections predominated. The vacant spaces noted appear particularly in the oblique-axis columns and signify that these corrective lenses were not encountered in this study.

The unaided visual acuities under the oblique-axis cylinder corrections are, as a rule, slightly less than those found under the horizontal or vertical meridians.

As the average age in the Hyperopic group increased, the average unaided visual acuity for the same correcting lenses became increasingly worse. This is physiologic and to be expected.

The age factor in the Myopic and in the Mixed-Astigmatism groups, apparently does not materially influence the results of the unaided visual acuity for the same correcting lenses.

nately, the methods of recording visual acuity are not uniform. Many letters of affidavit for applicants testify to such lack. Many ocular prescriptions for spectacles from military installations brought similar evidence.

To obtain a proper record of visual acuity the head and eyes of the examinee must squarely face the chart. No squinting, head tilting, nor turning must be per-

TABLE 1

TABULATION OF THE UNAIDED VISUAL ACUITIES FOR A REFRACTIVE ERROR WITH VARIOUS CYLINDER AXES, IN THE DIFFERENT AGE GROUPS*
Example: +1.50D. sph. \ominus +0.50D. cyl.

18-29				30-39				40+			
1	2	3	4	1	2	3	4	1	2	3	4
40	40	40	40	40	40	70	50	50	50	50	50
30	30	40	30	50	40	50	40	50	40	50	70
30	30	30	30	50	40	50	50	70	40	70	70
50	25	50	50	40	50	50	70	40	70	100	50
30	40	40	40	40	30	40	40		50	50	50
40	40	30	30	5	40		50	4	50	50	70
30	25		40	5	50	5	50		40	50	50
30	40	6	40		40			52	40	6	50
40	30	6	30		40	52	7		70	6	50
	30		40		40				40		
9	320		10		10				490		8
.35			37		41				49		57
	32										
(30-50)	(25-40)	(30-50)	(30-50)	(40-50)	(30-50)	(40-70)	(40-70)	(40-70)	(40-70)	(50-100)	(50-70)

Figures 18-29, 30-39, 40+, represent the different age groups.

Figures 1, 2, 3, 4, represent axes 45, 90, 135, and 180, respectively.

The average unaided visual acuity is recorded at the base of each column.

Each figure represents the denominator of the Snellen fraction; 20/.

The figures in parentheses represent the range of unaided visual acuity.

* The figures in each column represent but a fraction of the actual number tabulated for this refractive error.

The average unaided visual acuity of the Mixed-Astigmatism group, as a whole, was much better than that found in either of the other two groups.

In all groups, the average unaided visual acuities became worse as the refractive power of the correcting lenses increased.

As an interesting feature in this study, it was noted that Mixed-Astigmatism occurred more frequently in women.

COMMENT

Visual-acuity records, for the ophthalmologist, for the patient, and for statistics, are exceedingly valuable. Unfortu-

mitted. The vision should be tested both with and without glasses, provided glasses are worn, and the monocular as well as the binocular vision noted in each instance.

The Army physical-examination requirements specifically state that if the vision is within such and such range and correctable to such and such a value the individual will be classified thus, and so on. Any number of applicants are borderline problems, and an examiner is hard pressed to determine with a clear conscience just how to classify these individuals.

This study was undertaken because a need was felt for some simple expression

+CYLINDER

	Axes	45°	90°	135°	180°	45°	90°	135°	180°	45°	90°	135°	180°	45°	90°
	0	0.50				1.00				1.50					
0	0	25	25	25	25	30	30	30	30	30	40	40	50	60	60
0.50	25	30	30	30	30	40	40	40	40		40	50	50	60	60
1.00	30	30	30	30	30	40	40	50	40		50		50		70
1.50	30	30	30	40	40	50	40	50	50	60	50	50	60	70	70
2.00	40	40	40	50	50	60	60	60	60		70		70	80	80
2.50	50	40	40		50		60	60	70	80	80		80		80
3.00	60	60	70		80	70	70	80	70	100	100		100		100
3.50	70	80	80	80	100	80	80		80	100	100				100
4.00	80	80	80		100		100	100	100		100	100	100	200	200
4.50	100		100		200	200	100	200							200
5.00	200	200	200				200			200	200		300		
5.50	200		200		300		200				300				
6.00	300				300				300						

-CYLINDER

	Axis	45°	90°	135°	180°	45°	90°	135°	180°	45°	90°	135°	180°	45°	90°
	0	0.50				1.00				1.50				2	
0	0	30	30	30	30	40	40	40	40	60	60	50	50	80	80
0.50	30	40	40	40	40	40	60	50	50	80	70	70	70	100	80
1.00	50	80	70	70	70	80	100	100	80	100	100	100	100	150	150
1.50	80	100	100	100	100	150	150	150	150	200	200	200	150	200	200
2.00	100	200	200	200	200	200	200	200	200	200	300	300	250	300	300
2.50	200	200	200	250	250	250	250	300	250	300	300	300	300	300	300
3.00	300	300	300	300	300	300	300	300	300	400	400	400	400	400	400
3.50	300	400	400	300	300	400	400	400	400	18/400	400	400	400		18/400
4.00	400	400	400	400	400	15/400	15/400	16/400	16/400	18/400	18/400	15/400	16/400	15/400	15/400
4.50	17/400	16/400	17/400	16/400	18/400	16/400	15/400	15/400	15/400	15/400	13/400	13/400	13/400	12/400	12/400
5.00	15/400	15/400	13/400	13/400	15/400	12/400	13/400	7/400	12/400	10/400	12/400	10/400	12/400	10/400	11/400
5.50	13/400	11/400	9/400	11/400	12/400	11/400	14/400	12/400	14/400	10/400	12/400	11/400	12/400	8/400	10/400
6.00	9/400	7/400	9/400	8/400	10/400	9/400	10/400	4/400	8/400	5/400	8/400	5/400	8/400		8/400

+CYLINDER

[illegible]

by which an examiner could rely on the answers given. Such information would be of value not only for mobilization and demobilization purposes, but for certain phases of civilian life as well.

Only eyes free from organic defects and with vision correctable to the accepted Snellen standard of 20/20 within the range of 0 to 6.00D. spheres and 0 to 6.00D. cylinders, in half-diopter increases, singly and in combination, in all three refractive-error groups, were selected for this study.

Thorington,¹ in his book on refraction, stated, "The visual acuity under definite conditions is an index of the strength of the necessary spherical lenses (plus or minus) which will give a vision of VI/VI or more. For instance, the question which has been decided is this: If a healthy eye, Hyperopic or Myopic, without astigmatism (or an eye with its astigmatism corrected with a cylinder) has the ability to see VI/VI, and has its ciliary muscle under the effect of 'drops,' what strength spheric lens would be required to give it normal vision? To begin with the writer had to work backward, so to speak, and in the following manner: The eyes were tested at six meters, and with the lenses which gave standard vision the eyes were tested to find out what the visual acuities would be when plus spheres were placed in front of the correcting lenses."

Agatston,² in his paper on "Ocular malingering," presented a table on the correlation of uncorrected visual acuity with the refractive error for myopia, myopic astigmatism, and compound myopic astigmatism based on the results of experiments with six Army men. "These subjects, each with less than 1 diopter of refractive error, had full correction, and, one eye being used at a time, the various refractive states were simulated by employment of plus lenses at the anterior fo-

cal plane. . . . If necessary, the examiner, using himself as a subject, may properly simulate any refractive error he may encounter."

In both instances, simulation was the method chosen. Though the conclusions are noteworthy, they were based on too few observations.

The author, with the help of his assistant, did simulate the different refractive errors. It was soon apparent, however, that no matter how truthful he attempted to be, he could not avoid recognizing figures or numbers which were blurred, and which would, no doubt, be unrecognizable to an individual whose unaided visual acuity was correctable to the normal value by the corresponding refractive corrections used.

In this study the recorded unaided visual acuities of more than 50,000 individuals, men and women, of different age groups were correlated with the refractive errors.

The great majority of the unaided visual-acuity readings were encountered in the region of 0 to 4.00D. spheres and 0 to 3.00D. cylinders, singly, and in combination, in both the Hyperopic and Myopic refractive groups. These average unaided visual-acuity readings are highly accurate. Beyond the 4.00D. spheres and 3.00D. cylinders, singly, and in combination, fewer readings for these corrective powers were obtained. Though fairly accurate, they do not possess the high degree of accuracy noted for the corrective-lens combinations mentioned previously. The empty spaces noted occur particularly in the oblique-axis columns and signify that such refractive errors were not encountered in this study. They could, however, be filled by interpolation. Other studies of this character, made on greater numbers of individuals, would help to fill these blank spaces and to corroborate

the work which has already been accomplished.

Armed with such information, an examiner would be aided materially in the detection of malingerers. It would help in classification and assignment of individuals entering the service. Many individuals will, no doubt, claim compensation for visual impairment aggravated by the stress and strain of war. Except for those with traumatic or organic pathologic lesions of the eyes, the truth or falsity of such claims in subjects who have unaided visual acuities correctable to 20/20, with lenses, the refractive power of whose eyes had not changed, would be readily determined. Positive malingerers will, of course, be tested with other corroborative methods.

In certain phases of civil life—for example, in the case of compensation work, civil suits, insurance—such information can be of great value.

Similar charts for the Navy can be constructed by using the Conversion Formula of Allen.³

CONCLUSIONS

A study, correlating the unaided visual acuities with the different refractive errors, obtained from a review of more than 50,000 physical examination and refraction records at an Army General Dispensary, is presented.

Only eyes free from organic defects and correctable to 20/20, within a range of 0 to 6.00D. spheres and 0 to 6.00D. cylinders, singly, and in combination, in all three refractive-error groups, were selected for tabulation.

This study was undertaken because a need was felt for some simple expression by which to determine and confirm the truth or falsity of answers given by applicants during the ocular examinations.

The importance of this study is reflected in the fact that, armed with such information, borderline individuals could be properly classified, and malingerers detected. Such information is of practical value not only for mobilization and demobilization purposes, but for certain phases of civilian life as well.

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NOTES, CASES, INSTRUMENTS

A METHOD OF EVISCERATION OF THE EYEBALL*

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From time to time for many years articles have appeared on the subject of enucleation as compared to substitute operations. For a detailed discussion of the indications and contraindications for each, one may find an excellent portrayal of the subject in the American Encyclopedia of Ophthalmology for 1915¹ and in articles by Burch,² Guibor,³ and very recently in the published report of the symposium by Gradle,^{4a} O'Brien,^{4b} Kirby,^{4c} and Pfeiffer^{4d} at the 1944 session of the American Academy of Ophthalmology and Otolaryngology. Spaeth⁵ discusses the question in his book. Weigelin⁶ wrote on the subject in World War I.

We shall refer to only a few of the numerous variations in surgical technique in performing eviscerations. Gifford⁷ in 1900 reported 14 cases of simple evisceration (leaving the cornea) and favored this above the ordinary evisceration which is combined with keratectomy. In his operation, Gifford made a meridional incision three fourths of an inch long through the sclera midway between the external and superior recti, extending from within 3 mm. of the corneal margin toward the posterior pole of the eye. The contents of the eye were then scraped out through this incision, which was held apart with hooks or forceps. The scleral shell was collapsed by inserting gauze beneath the lids. Gifford stated that he had much less postoperative edema when he had used this method than after following

the ordinary procedure for evisceration.

In a subsequent paper, Gifford⁸ redescribed his evisceration technique. He believed that the Mules operation gave the best cosmetic result, but thought that the pushing of the anterior half of the eye into the posterior half was almost as good. Grimsdale and Brewerton⁹ have discussed evisceration technique in detail. Burch² has urged evisceration with preservation of the cornea. Others, including Huizinga,¹⁰ have recommended making an opening in the sclera posteriorly to permit drainage of fluid from the scleral cavity.

Burch,² in discussing his method of evisceration, advises as additional safety factors the wiping off of the endothelium from the cornea and the application of iodine to the scleral cavity, followed by cocaine neutralization and by irrigation. Other authors have recommended other chemical treatments of the cavity.

Potechina¹¹ reported a scleral cyst following evisceration of the eye. Mahoney¹² says he favors evisceration in many cases, but does not favor it if there is injection of the ciliary body, even if the surgery is done promptly after an injury.

Dimitry¹³ describes his evisceration technique in which he (1) cuts off the cornea and the sclera, including the ciliary-body region; (2) cuts out a piece of the sclera posteriorly, including a piece of the optic nerve; (3) implants a ball; and (4) makes V-shaped cuts in the sclera to allow it to fit more snugly over the gold ball. This is a modification of the Mules¹⁴ operation.

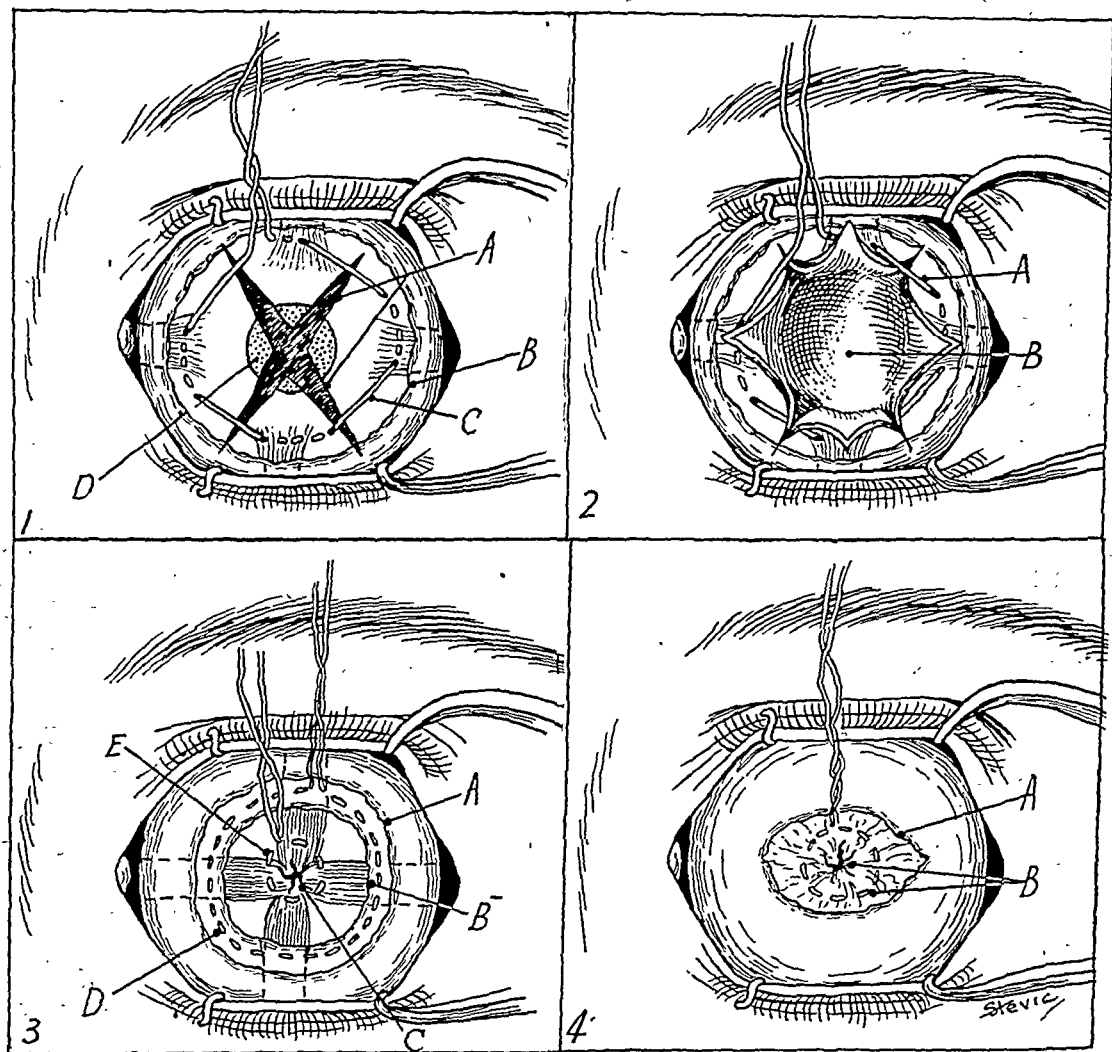
O'Connor,¹⁵ in 1930, described a technique of evisceration quite similar to the one which we have independently employed.

Several years ago, when confronted with a case of gross corneal laceration

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with extrusion of the scleral contents, the authors decided to perform an evisceration in a somewhat unconventional man-

to collapse in the following manner: The corneal and scleral lacerations were enlarged and supplemented by additional in-



Figs. 1-4 (Danielson and Long). Steps in performing evisceration. Fig. 1, appearance of eye with incisions made but lips almost closed. A, incisions in cornea and sclera; B, edge of conjunctiva; C, purse-string suture; D, cornea. Fig. 2, appearance of eye with lips held open and evisceration completed. A, purse-string suture; B, showing everted, cleaned sclera. Fig. 3, appearance after invaginating anterior lips into posterior portion by tying first purse-string suture. A, edge of conjunctiva; B, edge of Tenon's capsule; C, dimpled, inverted center; D, 2d purse-string suture; E, 1st purse-string suture. Fig. 4, appearance after both purse-string sutures are tied, before closing conjunctiva. A, edge of conjunctiva; B, position of first and second purse-string sutures.

ner. We had previously noted cases of evisceration with keratectomy in which the sclera remained for a considerable period as an open, secretion-filled cup. To avoid this difficulty, the sclera was made

cisions back to the equator. A purse-string suture was inserted about the equator, and the anterior portion of the eye was then invaginated into the posterior half and the sutures tied. A second purse-string

suture in Tenon's capsule combined with conjunctival sutures closed the wound. The result was excellent, and the technique has since been used on several occasions very satisfactorily.

The following steps are taken in performing the operation:

1. Circumcision of the conjunctiva at the limbus and retraction of conjunctiva and Tenon's capsule.

2. Four or more incisions, or extension of lacerations, of the cornea and sclera back to or somewhat beyond the equator (fig. 1).

3. Evisceration of contents of globe with curette and gauze. A small suction tip is of value in keeping the field clear. One must wait for complete hemostasis. Some surgeons might wish to treat the interior chemically (fig. 2).

4. Placing of chromic catgut sutures in the sclera.

5. Invaginating the anterior sections into the posterior portion (figs. 3 and 4).

6. Interrupted plain 5-0 catgut closure of conjunctiva.

7. Pressure bandage with adhesive which is allowed to remain from two to three days before changing.

The advantages of this operation are:

1. The sclera acts as the implant. 2. The interior can be thoroughly cleaned. 3. The recti muscles are connected with the implant. 4. The healing is rapid. 5. The final

cosmetic result is excellent. 6. Patients may be up and about and out of the hospital the day after surgery if necessary, especially if a pressure bandage is applied. 7. No implant to be extruded.

This operation seems particularly suited to cases of severe laceration of the anterior segment. It can also be used in painful eyes such as ones with absolute glaucoma or in those removed for cosmetic reasons. In these latter cases the first purse-string suture could be inserted before the eyeball is opened.

This type of evisceration is contraindicated in cases of acute endophthalmitis, for thereby organisms may be introduced into the peribulbar tissues. The operation can probably be safely done in cases of long-standing endophthalmitis because of a decrease in the virulence of the infection and a partially acquired immunity to the offending organisms. It would seem to be good practice to administer penicillin and sulfonamides in all cases in which the possibility of infection exists.

SUMMARY

The literature of the last 30 years on methods of evisceration has been reviewed briefly.

A method of evisceration, very similar to the one of O'Connor, is described.

324 Metropolitan Building (2).

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SCLEROMALACIA*

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At the meeting of the Academy of Ophthalmology and Otolaryngology held in New York City in 1936, I reported under the above title¹ the case of a woman, then 64 years of age, who had been the victim of rheumatism for 21 years.

At the time of her death, last October, she had been bed-ridden for 18 years with deforming arthritis.

Both eyes had been completely immobile for the preceding five years, fixed in the primary position. She was wasted to a skeleton. Her spine was rigid. There had been only perception of light for some years. Ocular pain was never intense, and rather best described as a burning sensation. This could be relieved by mild ointments. In the early stages of her condition the retinas could be seen, but evinced no pathologic change. The vitreous was clear. For a long time, however, the corneas had been opaque. It was assumed that tension was normal, although application of a tonometer was inadvisable. On autopsy it was found that all

extrinsic muscles were degenerated and reduced to mere cords. Absorption of the sclera had advanced well beyond the equator. There was in each eye an adhesion of the bulbus to the upper lid. Although no perforation of the sclera could be demonstrated, it is probable that perforation had occurred, thus accounting for the adhesion of the bulbus to the upper lid and bringing the case under Van der Hoeve's classification of scleromalacia perforans. (Van der Hoeve stated² that one of his cases had been under observation for 40 years before perforation took place.)

On enucleation of the right eye, the sclera, exceedingly thin throughout in each eye, was punctured at this point of adhesion. The vitreous was like water and entirely escaped. Even greater care was exercised in removing the left eye, and at the point of attachment to the upper lid a segment of tarsal conjunctiva was included. Thus the bulbus was removed intact. Both eyeballs seemed enlarged.

Pathologic diagnosis (report by Army Medical Museum): Scleromalacia (perforans?). Chronic active iridocyclitis.

"A (left eye). Behind the equator the sclera appears fairly normal; at the insertion of the recti muscles the fiber bundles are broken, the sclera becomes thin-

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ner and almost disappears over the ciliary body. The iris and the ciliary corona are diffusely infiltrated with chronic inflammatory cells, most of them of the lymphocyte series. Eosinophiles are fairly numerous and Russell bodies are present. The iris is stretched and somewhat attenuated by adhesions of the pupillary border to the cornea. The cornea is thin, irregular in width, vascularized. Bowman's membrane is absent, and the anterior lamellae are infiltrated with chronic inflammatory cells. The corneal epithelium is thickened, and irregular in width; Descemet's membrane is thick.

"The lens is not in place but was sectioned separately. It is small, irregular in outline, the anterior capsule wrinkled, and beneath it is a large amorphous deposit containing calcium granules. The capsular epithelium has disappeared in the center of the anterior surface over the amorphous deposit.

"B (right eye). This globe is partially collapsed (artefact); otherwise the picture is similar to the other eye. There is greater destruction of the sclera; the cellular infiltration of the cornea is slightly less marked; and the iris involvement more extensive. There are peripheral anterior synechiae as well as pupillary ones. In the pupillary area are pink masses adherent to the anterior and posterior surface of the iris, which appear to be hyalinizing scar tissue but may represent lens remnant. The cross section

of the optic nerve of this eye shows a sector of atrophy."

As a further contribution to the subject I quote from a letter from Sir Stewart Duke-Elder, who writes: "The patient with scleromalacia whom I saw in March was a woman of 56 who had been suffering from polyarthritic rheumatism for about 30 years, and is now a complete cripple with most of her joints ankylosed. The right eye showed two large areas over which the sclera had completely disappeared, exposing the uvea, and in the left eye, all around the ciliary region, a similar condition existed, there being only one or two bands of sclera remaining. In the left eye there was a circular ulcer all round the cornea, of an atrophic indolent type. Nothing in the picture suggested inflammation.

"I am proposing to do a mucous membrane graft from the lip to cover the exposed areas sometime in the near future.

"Apart from the very few references quoted in the second volume of my textbook I know of no more recent publications on this very rare condition. You can quote anything of this you like."

Thus little by little may be gathered together the facts having to do with this unusual condition. There is undoubtedly a connection between scleromalacia and deforming arthritis. It is to be hoped that this relationship can be established and explained.

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EPIDERMOID CARCINOMA OF THE CORNEA

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This condition is not extremely rare. There are, however, comparatively few reports in the current literature and still fewer that combine photographs and the pathologic report.

A man, aged 74 years, gave a history of a corneal disease which started 18

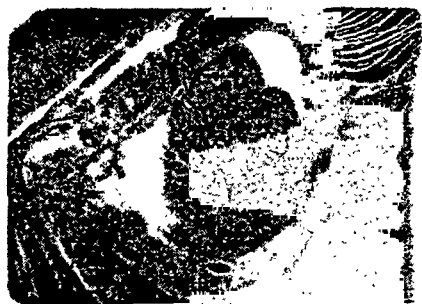


Fig. 1 (Bedell). Epidermoid carcinoma of the cornea. Left eye. Umbilicated, rough, nodular tumor mass covering the entire cornea.

years before I first saw him. He said that in the beginning there was a small spot on the side of "the clear part" (the cornea) of his left eyeball. He saw a physician, but no treatment was advised; so, during all of these years, he sought no further counsel, although from time to time the eye bled for a few days. He was conscious that his sight was steadily diminishing, and for the past several months knew that he was blind in that eye. He definitely stated that he had never had pain.

The right eye was essentially negative. With a correcting lens the vision was 20/20. There were no external evidences of inflammation and no fundus alterations.

The left eye was blind, the eyelids were free, the eyelid borders were not congested, the cilia were normal in number and size. The conjunctiva was only slightly injected near the junction of the inner canthus and lower lid. The entire cornea was an elevated, vascular mass with umbilication near the center (fig. 1). The surface was rough, lobulated, and nodular. There was a very narrow, crescentic extension beyond the nasal limbus; otherwise the bulbar conjunctiva and sclera were uninvolved. There were several fine vessels and an occasional larger one in and on the pale-pink friable tumor, which was several millimeters thick. A thin, mucopurulent discharge was adherent to the surface of the growth.

The patient was advised to have the eye enucleated. Following the operation he made an uneventful recovery.

The eyeball was sent to Dr. T. L. Terry of Boston, whose report follows:

Pathologic diagnosis. Epidermoid carcinoma, Group II, involving the cornea.

Microscopic description. At the level



Fig. 2 (Bedell). Epidermoid carcinoma of the cornea. Profile section showing the irregular surface, variable thickness, and neoplastic extension over the nasal limbus.

at which the sections were made, the entire cornea is covered with a relatively thick epidermoid carcinoma, Group II. In some places, the tumor is 3 mm. thick.

Its surface is irregular (fig. 2). Carried with it is a moderately large amount of stroma which contains a somewhat irregular distribution of blood vessels (fig. 3). In some places, the stroma is relatively vascular; in others, it appears almost avascular. Bowman's membrane has

vascularization is in the more superficial parts. Mesenchymal epithelium is absent in places. The iris angle is open, and the ciliary processes show some hyalinization. The lens cortex contains a few acidophilic vacuoles. The retinal separation appears to be a post-mortem change.

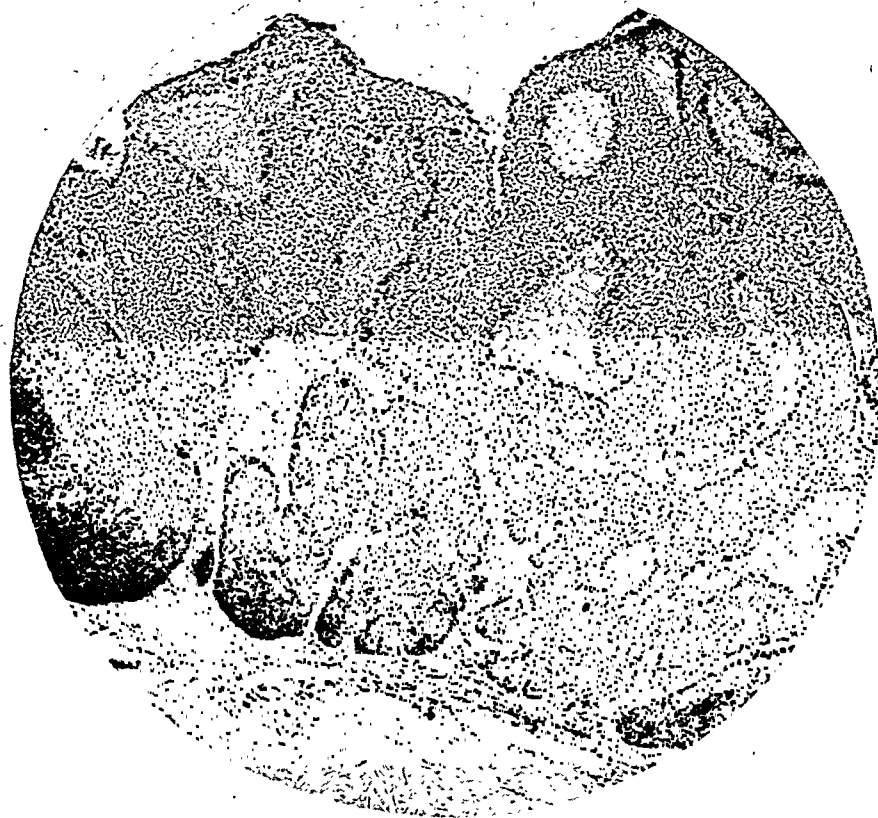


Fig. 3 (Bedell). Epidermoid carcinoma of the cornea. Low-power magnification, $\times 55$.

been eroded and destroyed over relatively large areas. At the central portion of the cornea, however, some Bowman's membrane is seen to be still present. The tumor does not appear to have gone into the substantia propria at any place. The cornea is infiltrated with wandering cells rather irregularly, some of which have taken on a flattened shape like corneal corpuscles (fig. 4). There is also some vascularization of substantia propria;

The photograph of the gross specimen shows the discrete and confluent nodules which are clearly distinguished by the differences in level.

On section, the tumor was found to be confined to the cornea except for a few millimeters beyond the nasal limbus.

This case is presented because of its unusual extent and the fact that it might be mistaken for leprosy and, of course, the reverse holds, that a leproma might

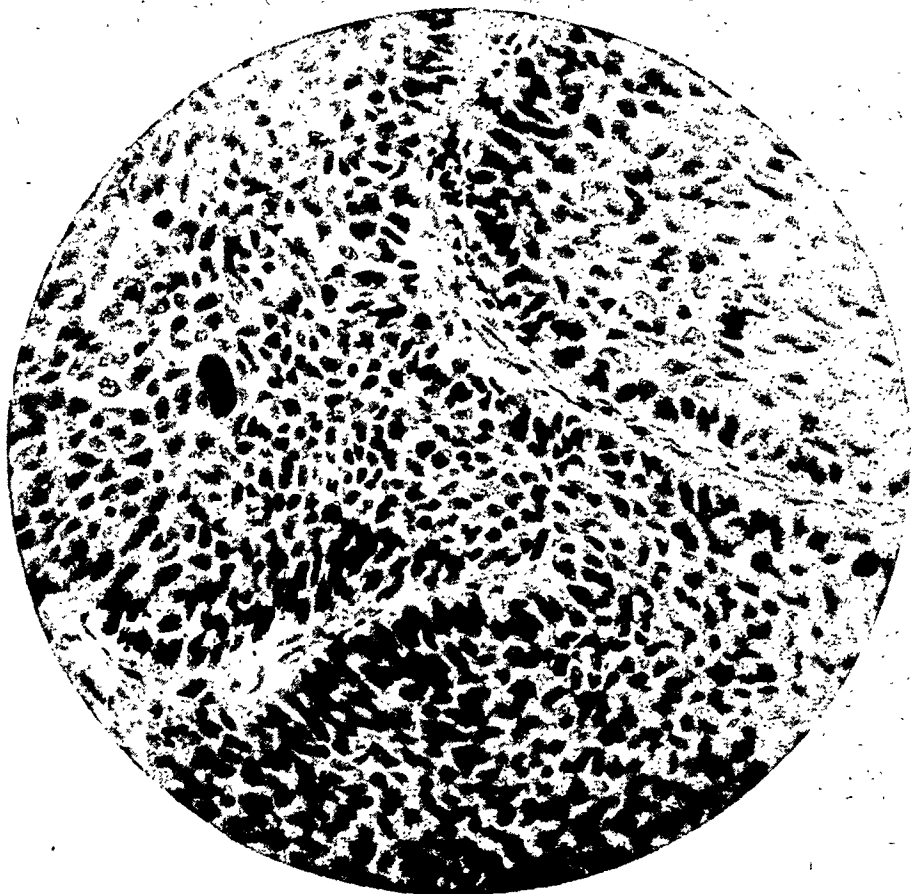


Fig. 4 (Bedell). High-power magnification, $\times 335$. Characteristic cells and grouping.

be mistaken for a malignancy. The latter is improbable on the part of any observant physician, for the corneal leproma is

a late manifestation and the other stigmata of advanced leprosy would be evident.

A photograph of a leproma is presented (fig. 5) to illustrate the practically complete loss of eyelashes, the bulbar conjunctival congestion and the tumor, the surface of which was smoother and not so uniform in thickness as the carcinoma. There was less tendency to bleed, although the vessels were larger than those in the neoplasm. The other eye was also affected for in leprosy both corneas are practically always involved.

A tuberculoma of this size would have other concomitant signs of tuberculosis and local inflammation.

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Fig. 5 (Bedell). Leproma. Smooth nodular corneal growth. The absence of the eyelashes confirms the diagnosis.

CHOICE OF GRAFTS FOR ORBITAL RECONSTRUCTION

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When a graft is necessary to line the orbital cavity in orbital reconstruction, the choice of graft is important.

Since Virchow first suggested that loss of mucous membrane be replaced by skin, the epidermal layer of skin has been used, until recent times, for resurfacing cavities such as the mouth, nose, orbit, vagina, and others, despite the fact that its epithelial cells become macerated, exfoliate, and produce a foul-smelling discharge.

Wolfe¹ was the first to report the success of mucous-membrane transplants, and, following the demonstration of Esser² that free grafts could be successfully applied as a lining to replace mucous membrane of the mouth by placing the graft around a mold or stent (epithelial-inlay grafting), the problem of cavity lining has been somewhat simplified.

The ideal graft in orbital lining is mucous membrane, and the choice of donor site will depend on whether the patient is male or female. Having tried all the available donor sites, I have listed these in the order of their preference: Male—(1) mucous membrane of mouth;

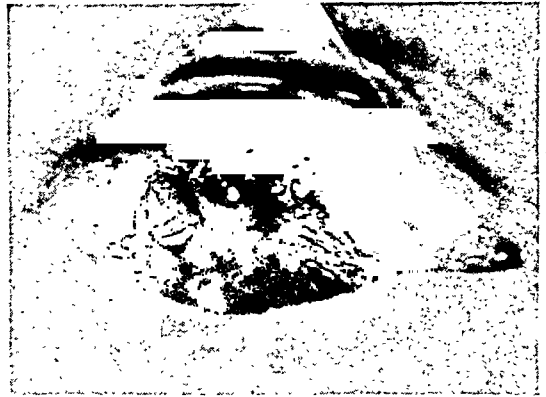


Fig. 2, Same patient as in figure 1. Shows orbital cavity relined with rectal mucosa.

Figs. 1-3 (MacKenzie). Reconstruction of orbit, using lining of rectal mucosa. Fig. 1, Patient as he appeared after several previous attempts at reconstruction. Note the typical depression of the upper lid and the nick in the center of the tarsal cartilage.

Fig. 3, Same patient as in figures 1 and 2. Shows the stent containing the orbital graft in place with eyelids sutured together. The nick in the tarsal cartilage has been corrected, and the normal contour of the upper lid has been restored by a transplant of fascia lata inserted through an incision in the hair line of the eyebrow.



(2) mucous membrane of prepuce; (3) rectal mucosa; (4) nasal mucosa. Female —(1) vaginal mucous membrane; (2) oral mucous membrane; (3) rectal mucosa; (4) nasal mucosa. The nearest ap-

tant because of the tendency of the glandular elements to become modified by change of environment.

The choice of donor site is determined by simple surgical principles; namely, the



Fig. 4 (MacKenzie). Same patient as in figures 1-3, showing end results.



Figs. 5-7 (MacKenzie). Reconstruction of orbit using lining of mucous membrane taken from the prepuce. Fig. 5, Condition prior to operation.



Fig. 6, Same patient as in figure 5. Orbital cavity relined with mucous membrane from prepuce.



Fig. 7, Same patient as in figure 6. End results.

proach to a completely successful orbital graft, following several previous failures from preferred donor sites, was accomplished in one case with rectal mucosa.

The difference in the glandular character of these various sites is not impor-

source that can supply the tissue which most closely simulates the conjunctiva; that can be removed with least difficulty; and that will cause minimum inconvenience to the patient. Only on rare occasions will the surgeon be called upon to choose between nasal and rectal mucosa. Of

equal importance to the choice of a donor site is the making of an accurately fitting stent.

Dental modeling compound or wax has never met the requirements for orbital impressions because both distort the tissues and offer difficulties in sterilization. These are largely avoided by using the hydrocolloid-impression material with especially designed, water-cooled trays.

More recently the colloid powder, which I autoclave for 15 minutes and mix with sterile water, further simplifies orbital impressions by eliminating the need for the cumbersome, water-cooled trays. The stents are made of clear acrylic (lucitone) and kept in 70-percent alcohol until used.

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RETINAL DETACHMENT SECONDARY TO CONGLOMERATE TUBERCLE OF THE CHOROID

REPORT OF A CASE

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Solitary or conglomerate tubercle of the choroid is a rare form of ocular tuberculosis. The first descriptions of this condition in medical literature were those of Von Graefe, Jaeger, Manz, Bouchert, Frankel, Haab, Cohnheim, and Weis. The forms described are: (1) choroidal miliary tubercles, (2) granuloma or solitary tubercle. The first is often associated with acute miliary tuberculosis and the second with chronic tuberculosis.

Conglomerate tubercle of the choroid is, as a rule, unilateral; it occurs most frequently in children and is probably secondary to tuberculosis in other parts of the body. According to Zur Nedden, it has occurred in 62-year-old individuals. Examination with the ophthalmoscope reveals it as an intraocular mass, yellowish white in color. Retinal involvement may occur with subsequent retinal detachment. The diagnosis is often diffi-

cult because one must differentiate the tuberculoma from the following pathologic processes: Retinoblastoma or glioma in children, sarcoma in adults, occasional metastatic deposits of carcinoma in the choroid, idiopathic retinal detachment, retinal cyst, and Coats's disease (massive exudates). Enucleation and laboratory confirmation may be necessary in some cases to establish the diagnosis. According to Verhoeff, this condition is inadequately described in textbooks. Recent publications by Berens, Troncoso, and Wolff discuss this subject.

CASE REPORT

A white man, aged 27 years, was admitted to the hospital on August 20, 1944. His previous history included three months' hospitalization for retinal detachment of the right eye of undetermined origin. Prior to the hospitalization, he had complained of impaired vision, severe headaches, and redness of the right eye. Examination revealed a large retinal detachment present in the right eye from the 11- to the 2-o'clock position. The cornea and lens were clear. The disc margins were quite indistinct, and there

was a pale, yellowish-white mass, about one disc diameter in size, in the right inferior temporal quadrant. The tension appeared to be within normal limits. Vision in the right eye was reduced to perception of finger movements. Previously, the patient's visual acuity had been 20/20, O.U. No abnormal findings were discoverable in the left eye.

Laboratory findings. Red blood cells, 4,600,000; white blood cells, 7,500; neutrophils 58 percent; lymphocytes 30 percent, eosinophiles 12 percent (hookworm); hemoglobin, 94 percent. The Wassermann test and urinalysis were negative. Roentgenograms of the skull, sinuses, and chest were within normal limits. Ova of *Necator americanus* were present. Sputum examination was negative for tubercle bacilli. Urinalysis for melanuria was negative.

Treatment and Course. The diagnosis of hookworm was established, and adequate treatment was given. The patient complained of persistent, severe headaches, and a feeling of pressure behind the right eye. Narcotics were necessary to relieve these symptoms. Enucleation was performed on November 7, 1944, because of a possible choroidal tumor. The headaches were somewhat relieved after the operation, but soon returned. On February 27, 1945, the patient received a plastic prosthesis for the right eye. His case was followed for approximately a year after the operation; he still complained of severe headaches that occurred once or twice a week and lasted for one or two days. Repeated roentgenograms of the skull were negative. Neurologic examination was entirely negative. The pathologic diagnosis was: Granuloma, chorioretinitis, possible tuberculosis (Ash).

Intradermal tuberculin tests after the pathologic report was received were posi-

tive to a very weak dilution of old tuberculin. The sections were reviewed by Klien, who commented as follows: "Sections through the chorioretinal lesion show it to be an old hypertrophic type of chorioretinal scar. The granulation tissue seems to contain some epithelioid cells in addition to the rather obvious giant cells, and the still-preserved portions of the choroid have slight round-cell infiltration. This may be a tuberculoma, an assumption rather supported by the findings in the celloiden section. In this section the retinal periphlebitis, the numerous preretinal precipitates, and the mild optic neuritis would fit very well into the picture of a solitary tuberculous lesion in the eye, the retinal manifestations distant from the lesion being an allergic reaction."

COMMENT

A review of the literature by Horning and Lamb included 55 cases of tuberculoma of the choroid. A few cases have since been added. The condition is usually unilateral, but both eyes may be involved. Verhoeff is of the opinion that "Retinal tubercles do not arise by direct metastasis through the blood stream, but are produced by infected cells which have invaded the vitreous."

Burch replied in regard to this case: "I have never felt quite satisfied with a diagnosis of tuberculoma. In a few sections of that title which I have, I have not been able to demonstrate the tubercle bacilli in them, although the diagnosis was made on the usual pathologic findings. In this case the possibility of 'foreign body giant cells' was suggested." Dodds reported a case of tuberculoma in which all the tissues of the eye were involved. Many tuberculous giant cells were present. Direct smears from the enucleated eye failed to disclose any tubercle bacilli. A guinea pig was inoculated with smears from the eye,

and later the acid-fast bacilli were found.

Finnoff stated: "Conglomerate tuberculoma are often fortunately diagnosed as malignant and only correctly diagnosed microscopically after enucleation." The use of graduated tuberculin skin tests may help in the differential diagnosis. Tuberculous lesions may also appear in other organs as well as the eye, especially the brain. The persistent cephalalgia in this case might be explained on that basis.

SUMMARY

1. A case of conglomerate tubercle of

the choroid with laboratory confirmation is reported.

2. The first diagnosis in this case was idiopathic retinal detachment.

3. The eye was enucleated because of a suspected melanosarcoma of the choroid.

4. The final diagnosis was not confirmed until after the pathologic report was received.

5. The tuberculin skin test may at times be of aid in establishing a diagnosis.

6. A correct diagnosis is often difficult to arrive at in these cases.

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SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

ROYAL SOCIETY OF MEDICINE

SECTION OF OPHTHALMOLOGY

February 8, 1945

MR. P. E. H. ADAMS, *president*

Abstracted by permission from the Proceeding of the Royal Society of Medicine (Section of Ophthalmology), 1945, volume 38, number 3, sectional page 25.

INJURY TO THE LEFT EYEBROW ASSOCIATED WITH SEVERE VISUAL LOSS

Mr. E. F. KING presented O. L., a man, aged 35 years. This patient fell up some stairs. He was not unconscious and walked to the hospital where stitches were used to close a lacerated wound of the left eyebrow. His eyes were examined for the first time on January 23, 1945, when he complained that the vision of his left eye had been defective since the accident. He gave no history of previous eye trouble and had never worn glasses.

Vision of the right eye was 6/6. There was early macular degeneration, apart from which the eye was healthy. Vision of the left eye was limited to ability to count fingers in the lower field. There was a stitched, lacerated wound in the outer half of the eyebrow. There was no irregularity of orbital margin; no displacement of globe; and movements were full. No mass was palpable in the orbit. The pupil was very sluggish on direct light stimulation; good consensual reaction. The media were clear. Apart from slight macular degeneration, essentially similar to that present in the right eye, the fundus was normal. The only visual field present was in an area below fixation, extending to the periphery. The X ray failed to reveal any foreign body or

fracture of the orbit or optic canal.

When the patient was examined again on February 2, 1945, there was some improvement in central vision, now approximately 2/60. There was slight relative temporal pallor of the optic disc and considerable extension of the field of vision, which now embraced fixation.

DUANE'S RETRACTION SYNDROME

WING COMMANDER A. J. ELLIOT presented this subject. Duane's retraction syndrome is characterized by deficiency of abduction, partial deficiency of adduction, retraction of the globe when the eye is adducted, oblique movement when adduction is attempted, narrowing of the palpebral fissure during adduction, and deficiency of convergence.

The syndrome was described in detail by Duane (1905) in a report of 54 cases of congenital deficiency of abduction with retraction, 5 of which were bilateral. He observed that the retraction of the globe may vary from 1 to 10 mm. on adduction. He felt that the retraction was due to the inextensibility of the external rectus muscle, which failed to enlongate, and hence the internal rectus muscle could contract only by retraction of the eyeball. In 9 of the 54 cases, the affected eye protruded slightly when abducted. Duane believed that the narrowing of the palpebral fissure was not a ptosis, but that it was due to the contraction of the orbicularis muscle, the closure being effected as much by an ascent of the lower lid as by a descent of the upper lid.

An atypical form of the retraction syndrome is the condition of strabismus fixus in which there may be a fibrosis of both the internal and external recti. Aebli (1933) reported two cases of this syn-

drome in which the internal rectus muscle was fibrous and attached to the globe at the equator.

The etiology of the condition is not certain. It is not likely that it is due to a birth injury, as Gifford (1926) reports a typical case of the retraction syndrome in an individual who was born by normal Caesarean section. White (1944) considers that the condition is a congenital aplasia of the rectus muscle.

No treatment is required if there is binocular single vision in the central part of the field of fixation. In cases wherein a disfiguring squint or diplopia is present, the only treatment is surgical. Most commonly a moderate recession of the internal rectus muscle is indicated. However, the surgical procedure may be varied according to the findings in each case.

THE CORROSION OF SHARP-EDGED OPHTHALMIC INSTRUMENTS

MR. J. FOSTER, MR. C. H. LEMAY, and MR. K. I. JOHNSTONE discussed the extent of the problem.

E. F. Kayser, senior technologist, Gillette Industries, Ltd., has shown that: "Rusting may occur on the roughest part of a cataract knife (the ground zone) before use, when supplied ungreated, and that rust spoils edges (to a variable extent owing to marked variations in grinding) quicker than use."

CORROSION IN STORAGE. Due to atmospheric water, salt, and acid, corrosion occurs on all ungreated knives, and is most marked in operating-theater cupboards, which have a water-vapor tension equal to that of shops, but a temperature 4.1° above them. This can be reduced by silica gel and lime desiccators, careful handling, and mineral grease.

ANTIDOTES TO CORROSION IN STERILIZATION. Rusting is worst on the ground zone, on curved edges, and on high car-

bon steel. Experimental knives and trephines of beryllium bronze proved moderate clinically and substandard by photomicrography.

Hot-air Sterilization is only slightly corrosive and kills spores, but is slow and requires a big outlay on the sterilizer and multiple sets of instruments.

Hot Mineral Oil is noncorrosive and produces complete sterility. It is slow and difficult to remove. If vegetable oil is employed, each heating produces fresh corrosive fatty acids, gummy polymerization, and oxidation products.

Chemical Methods. *Alcohol* is useless, being corrosive (due to acetic acid and aldehydes) and will not kill even *Staphylococcus aureus* at 130°C. in one hour. *Phenoloids* (antiseptol) Post's solutions, "Dettol," do not kill spores and require washing or boiling to remove them prior to operation. *Mercurials* (metaphen) attack aluminum and possibly steel. This is reduced by addition of borax. *Formaldehyde* (Bard-Parker solution, Liquor sterilisans) kills spores, but Burlingame says 1 to 18 hours are needed if organic matter is present. As spores are killed with certainty by formaldehyde among noncorrosive chemical agents, grease may interfere with their action, and most of them require preoperative removal by aqueous washing or boiling. The method is not without disadvantages. Admittedly spore infection is rare, although recorded by Silberschmidt, Ulbrich, and Marchesani, and corrosion is slight where exposure to water is minimal (Post's solutions, Dettol, and liquor sterilisans).

Boiling in Water is a simple, detergent, complete, and rapid mode of sterilization. All spores die in five minutes if 2-percent Na_2CO_3 is added to the water. Although the Na_2CO_3 reduces rusting by its alkalinity, some knives are spoiled in it by only half a minute's boiling (a period lethal to all-vegetative forms). NaOH and

NH_4OH added to the water prevent rusting, but the risks of carry-over are too great. Chlorates, chromates, phosphates, and nitrites reduce rusting. Neutralin, which is used in dental sterilizers, is superior to Na_2CO_3 alone and could be a useful addition to the dipping technique, but it will not preserve cataract knives for five minutes.

High-Frequency sound and electricity are both possible fields for experiments, although the former is more successful with larger organisms (yeasts), and eddy currents would require both inert atmospheres and special controls to prevent a rise above 200°C . and to avoid tarnish and drawn temper.

CORROSION IN DRYING. Knives last longer in Indian clinics owing to the generally alkaline air, immediate use on sterilization, and immediate drying after section by well-drilled theater teams. We should copy them, for slow pre- and post-operative drying may cause rust as much as boiling.

Na_2CO_3 crystals on the blade produce surprising rust effects, and blood saline and Na_2CO_3 may produce a "cell" on the steel where they touch, and local pitting result. The knife blade, being thin, cools rapidly and therefore dries slowly.

ANTIDOTE TO CORROSION. A possible antidote to corrosion in all three stages may be found in AC.10 (surgical) described by C. H. LeMay, B.Sc., of Manchester Oil Refinery Ltd. AC.10, the lightest of a series of anticorrosive products developed as the result of many thousands of experiments, consists of 95 percent of a light petroleum neutral oil and 5 percent of a complex of sodium salts of petroleum sulphonic acids (the inhibitor). Neither the oil nor the inhibitor alone is an effective corrosion preventive. To obtain optimum protection in a given set of conditions of exposure to corrosive attack, both the oil constituent and

the mixture of sodium petroleum sulphonates must be carefully selected and mutually adjusted for compatibility.

AC.10, itself, was not originally prepared for protecting surgical instruments during sterilization; it was selected as the most likely of the existing range to satisfy the special conditions of this type of exposure, and its formula was adjusted to produce the modification known as AC.10 (surgical), referred to below as AC.10 for brevity.

Experiments checked by high-power microscopic examination showed: (1) That a cataract knife (1.55-percent carbon steel) if dipped for 15 seconds in AC.10 can be kept indefinitely in water vapor, or water at room temperature, without rusting. This satisfies storage requirements. (2) That a cataract knife first dipped for 15 seconds in neat AC.10 can be boiled for 55 minutes in a 2-percent w/v solution of $\text{Na}_2\text{CO}_3 \cdot 10 \text{ H}_2\text{O}$ in water in which 2-percent v/v of AC.10 has been emulsified, without corrosion. If it is redipped in neat AC.10 every 15 minutes, it can be boiled without corrosion indefinitely. This satisfies sterilization requirements.

After operation a sufficient film remains on the knife to protect it for a reasonable period before cleaning (15 to 20 minutes); after cleaning, the film should be renewed by dipping for 15 seconds in neat AC.10 before putting the knife away for storage.

The emulsion should be prepared by dissolving the soda crystals in a relatively small portion of the total water (distilled or well boiled), adding the AC.10 slowly, with vigorous agitation, to this concentrated solution to form a coarse, concentrated suspension, which is then added to the remainder of the water. A fine homogeneous emulsion is formed when this mixture is boiled in the sterilizer.

The protection afforded by AC.10 is

due to the inhibitor so affecting the relation between interfacial tensions in the metal-water-oil system that a film of oil—effective even if monomolecular—is always preferentially formed on the metal surface. In the course of sterilization, when the ebullition might interfere mechanically with the film, the special balance of its ingredients comes into play: the hydrophobic long-chain radical of the inhibitor molecules remains anchored in the oil while the polar sulphonogroup is hydrophilic and permits the formation of an emulsion. Each particle of the boiling liquid therefore carries its own quota of AC.10 with it, and if the film on the instrument is disturbed it may be said to be replaced as rapidly as it is removed.

The effect of emulsifying AC.10 in the soda solution on materials other than metal used in surgical instruments is: *Ivory*—unaffected; *Silk* (experiments by Professor Speakman, University of Leeds)—not significantly affected; *Natural rubber*—elongation 10.5 percent after six hours' boiling—not significant in practice, but synthetic rubbers, which would be totally unaffected, could be substituted if desired; *Insulating varnish*—unaffected; *Glass*—refluxed for 70 hours—insignificant losses; *Aluminum handles*, unless dipped initially in neat AC.10, are slightly attacked by the alkali.

The AC.10 method permits sterilization by boiling, without corrosion, of all instruments for ophthalmic surgery rapidly and simultaneously in existing sterilizers.

As knives can be boiled for five minutes or more in 2-percent $\text{Na}_2\text{CO}_3 \cdot 10 \text{H}_2\text{O}$ without harm by the AC.10 technique, one of us (K. I. J.) determined whether protection of the cataract-knife blade by immersion in AC.10 and subsequent boiling in an emulsion of AC.10 in sodium-carbonate solution could be used

to replace the customary boiling in a 2-percent solution of sodium carbonate (decahydrate), without invalidating sterilization.

Technique. The blades were sterilized by flaming and each was dipped into a dense suspension of one of the following organisms in broth:

Staphylococcus albus (coagulase negative)

Staphylococcus aureus (coagulase positive)

Bact. coli

Streptococcus pyogenes (from a septicemia)

Pneumococcus type I

Bacillus subtilis (with spores)

After drying, the viability of the organisms on each blade was tested by making a small stab culture in an agar plate, or heated blood-agar plate for the streptococcus and pneumococcus, using only the extreme tip of the blade. Only the pneumococcus failed to give growth in most experiments (see first line of the table).

Each blade was then dipped into (1) cold, sterile AC.10 for 15 seconds, and (2) a 2-percent v/v emulsion of AC.10 in a 2-percent w/v solution of sodium carbonate (decahydrate) in distilled water, at boiling point, for 5 minutes, using a separate tube for each blade and for each reagent. Stab cultures were then made in duplicate with each knife, using the whole length of the blade. In every case, the final stab cultures were sterile after incubation at 37°C. for 18 hours (see the second line of the table).

To test for bactericidal action of the AC.10 and its emulsion, the experiment was repeated, using tubes of emulsion at room temperature (see the third and fourth lines of the table). On *Staphylococcus albus* and *aureus* and on *B. subtilis*, the AC.10 and its cold emulsion had no effect, abundant growth being obtained

in each final stab culture. *Bact. coli* gave irregular results, no growth being obtained in several experiments, due apparently to the action of the sodium carbonate itself. The streptococcus was killed in all cases at room temperature, whereas the pneumococcus rarely survived drying on the blade.

hibited on the surface of heated blood agar.

CONCLUSION. Protection of inoculated cataract knives with AC.10 and incorporation of AC.10 as a 2-percent emulsion in the 2-percent solution of sodium carbonate (decahydrate) in which such knives are boiled, does not interfere with sterilization, which is effected within 5

THE STERILIZATION OF CATARACT KNIVES IN THE PRESENCE OF AC.10.

	Stab culture	Nutrient Agar				Heated Blood Agar	
		Staph. albus	Staph. aureus	Bact. coli	B. subtilis with spores	Str. pyogenes	Pneumococcus
Sterilizing experiment: Emulsion at boiling point	Initial	+	+	+	+	+	0
	Final	0	0	0	0	0	0
Control experiment: Cold emulsion	Initial	+	+	+	+	+	0
	Final	+	+	+	+	0	0

+ = Growth.
0 = No growth.

Two further lines of investigation were followed, being suggested by the aforementioned results, which are here only briefly reported:

(1) The rate of destruction of *B. subtilis* spores in the emulsion of AC.10 in sodium-carbonate solution at its boiling point and in the separate constituents of the emulsion.

It was found that the spores of *B. subtilis*, a proportion of which will retain their vitality after boiling in water for 10 minutes, are rapidly destroyed in the emulsion at boiling point, 5 minutes being adequate to attain sterility. The presence of sodium carbonate was essential to the destructive effect of the emulsion.

(2) The bactericidal action of AC.10 emulsions for *Str. pyogenes* and the pneumococcus. AC.10 as a 2-percent emulsion in distilled water is markedly bactericidal for the pneumococcus; less so for *Str. pyogenes*, and has no comparable action on *Staph. albus* or *aureus*, *Bact. coli* or *B. subtilis*. Bactericidal action is in-

minutes for all organisms tested.

BIOLOGIC REACTIONS OF AC.10. Professor Passey (Department of Experimental Pathology and Cancer Research, University of Leeds) arranged facilities for intensive instillation in the conjunctival sacs of rabbits for two weeks with a negative result, and added that the dilution and time factors would invalidate any remote effect from the irritant substances occasionally present in petroleum.

In 120 eye operations, including 25 cataracts, which have been carried out successfully by this method since November, 1944, there has been no reaction.

STERILIZER DESIGN. If the surgeon trying the method is disconcerted by the slight greasiness of the instruments, a separate compartment can be made in the sterilizer for AC.10 emulsion (for knives and keratomes only, in a small tray). One rub with sterile gauze brings all except molecular film off the handles, and a touch removes any excess from the blade. If the slight greasiness causes no incon-

venience, or if there is time to rub each instrument separately, all can be sterilized together in existing sterilizers. Trays with a locking bar to hold instruments in order of use, and to serve simultaneously as lifting fulcrum, are made to the design of one of us (J. F.) for both methods by Thackrays of Leeds.

AN ARTERY IN THE CANAL OF SCHLEMM

MR. EUGENE WOLFF in describing this vessel said that it lay toward the posterior (the scleral-spur end) of the canal of Schlemm.

It has a well-developed muscularis and is, therefore, an artery. It is some 60 μ in diameter and contains red cells, whereas the canal on either side of it appears empty.

The artery is surrounded by loose connective tissue which is not sclera, for its texture and staining properties are different. It stains, in fact, like that tissue which is normally found in varying quantity between the endothelium of the canal of Schlemm and the sclera.

Superficially, this tissue meets the sclera, while on its deep surface it is continuous with the spongework of the ligamentum pectinatum.

The artery, therefore, lies in the canal and not in a partition between two portions of it. This may or may not be of purely histologic interest. Followed in serial sections, the artery is found to come from the anterior ciliary arteries. It is part of a circular vessel which runs parallel with the canal.

Maggiore, in his classical article, was the first to describe arteries as occurring normally in the immediate neighborhood of the canal of Schlemm. This has been confirmed by Theobald and others. Maggiore figures a circular artery running close to, and parallel with, the canal, and some of his illustrations appear to show

an artery actually in the canal.

The finding of an artery in the canal of Schlemm, therefore, should cause no surprise. It might quite well be that, if the huge work of cutting complete serial sections were undertaken, an artery might be found in some portion of the canal in every globe. In any case, it is part of the circular artery figured by Maggiore.

As to the significance of an arterial system of vessels in close relation to the canal of Schlemm, it seems probable that they may exist, since the sclera itself requires very little nourishment, for supplying those afferents to the canal to which Friedenwald has lately drawn attention.

The artery here described was found during the routine examination of sections of an eye removed for malignant melanoma of the iris, which, however, had nothing to do with its presence.

THE EFFECT OF ALUMINUM AND ITS ALLOYS ON HUMAN AND RABBIT EYES. A SYNOPSIS

MR. L. H. SAVIN said that his interest in the subject was aroused by seeing, among the Dunkirk wounded, a number of eyes in which aluminum-alloy fragments were embedded. He followed for three years the case of a young sergeant in whose only eye a fragment of aluminum zinc lay in the retina. The metal was at first bright and silvery. Later, it became coated with a white cover of hydroxide. The fragment shifted twice, each time leaving a retinal "imprint," before eventually disintegrating into white powder. A second case behaved similarly.

Thirty-one implantations of aluminum and alloy fragments were made into the anterior chambers of rabbits by a standardized technique; and 10 vitreous-chamber implantations. There was no clinical difference in the behavior of pure alumi-

num and various alloys tried in doses varying from 0.3 mg. to 20.0 mg.

The fragments were observed to become coated with white powder, with a yellowish exudate, with fibrin, or in late cases with jelly. A late change often seen was powdering and fragmentation of the metallic fragment. In six cases, the fragment was completely absorbed.

Common local changes were necrotic "imprints" left by the metal; of these, 6 imprints were corneal, 12 on the iris (9 gray, 2 white, 1 necrotic), 2 in the lens, 4 in the fundus.

General effects on the eye included lens opacities in 28 eyes. Types of opacity included striae in 13 cases, dots or vacuoles in 10, irregular opacities in 10, and 4 cases with polychromatic luster. The situation might vary: 5 anterior-capsule instances; 6 anterior-cortical, 2 capsular imprints, 3 complete cataracts, 4 posterior-cortical.

Quiet inflammatory changes in the uveal tract were frequent. There were: 10 posterior synechiae, 2 cases of iris bombé, and 14 cases of iris atrophy.

Other changes included pathologic fundus pigmentation in 23 instances, 6 cases of localized choroiditis, 3 of retinitis proliferans. In order to obtain standardization of fundi initially, a special chin-chilla-rex cross was bred. Partial coloboma of the choroid was not uncommon in rabbits.

Pathologic vascularization occurred often; there were not enough controls to decide whether the reaction was specific for aluminum.

Among other oddities were noted 2 cases of bullous keratitis, 1 staphylomatous eye (false buphthalmos), 2 cases of zonular keratitis, 1 interstitial keratitis, 1 deep keratitis, 2 pigmented corneas, 1 pigmented limbus, 2 folds in Descemet's membrane. These were interesting but statistically unimportant.

Histologic changes were mostly what would be expected from the clinical appearances. Attempts were being made to trace the aluminum through the tissues by special dyes.

Altogether it was definite that aluminum was by no means inert as supposed by some previous observers. In these cases, the experimental fragments had been probably left insufficiently long.

DACRYOCYSTORRHINOSTOMY: A SIMPLIFIED METHOD

MR. T. M. TYRRELL presented this subject and illustrated his talk by a moving-picture film. He said that the main points of the operation were: (1) The incision was a long one to give a good exposure. (2) The operator attempted to remove the lacrimal bone in one piece by three blows with the hammer and chisel. (3) No attempt was made, as in other operations of this nature, to preserve the nasal mucosa, as it was not used in this operation to make the anastomosis. (4) The patency of the anastomosis was assured by repeated syringing over a long period.

Mr. Tyrrell did not wish to advocate this as a superior operation to those already practiced, but wished to point out that it had the great advantage of speed, as it could be done easily in 10 minutes, provided that one used some form of sucker to control the bleeding.

The anesthesia was 5-percent novocaine with adrenalin for the skin and tissues down to and including the periosteum. For the nasal mucosa, the nose was first sprayed with 20-percent cocaine and then a pledget of wool on an orange stick was pushed up the nose armed with cocaine and adrenalin paste.

LOS ANGELES SOCIETY FOR OPHTHALMOLOGY AND OTOLARYNGOLOGY

SECTION ON OPHTHALMOLOGY

May 28, 1945

DR. A. RAY IRVINE, *chairman*

SYMPOSIUM ON CONGENITAL ANOMALIES OF THE EYE FOLLOWING RUBELLA

Dr. A. Ray Irvine opened the symposium by stating that, due to recent articles in the literature, a new interest had arisen concerning congenital cataracts. He stated that he and his fellow staff members of the Children's Hospital were conducting the symposium for the purpose of advancing their information on the subject.

Dr. John P. Lordan stated that he began to realize the existence of this syndrome 18 months ago. He said that since Dr. Albaugh had recently written a paper on this subject, perhaps it would be better for him to summarize the problem before the discussion began.

Dr. C. H. Albaugh summarized the material available at the Children's Hospital.

Dr. A. Ray Irvine opened the discussion by bringing out the differences in type of cataract. He had seen approximately six to date. Two of these were also associated with buphthalmos and all of them with congenital heart disease.

Dr. Henry of Pasadena brought up the subject of abuse of the theory that abortion should be induced in young mothers who are known to have had rubella in the first few weeks of pregnancy. He felt that many might present themselves and state that they had had rubella merely in order to have their pregnancy terminated.

Dr. John P. Lordan suggested that the Section should bring up material and summarize it; then send such material to the Governor of the State of California, with the view to specific legislation.

Dr. A. Ray Irvine said that he agreed

it might be advisable, but that the consensus seemed to be that we should know more about the disease syndrome.

Dr. Sidney Brownsberger discussed the use of convalescent serum. He felt that, in as much as it works in measles, it might well be of value here.

Dr. Albaugh agreed with Dr. Brownsberger that it might be advisable, but he felt that in a great many instances women do not realize they are pregnant until it is too late to give such serum; moreover, specific convalescent serum would be available only in large centers where there are communicable-disease hospital units.

Dr. Jeancon said that in her experience only 50 percent of women who had had rubella in the early stages of pregnancy gave birth to babies with congenital cataract.

Dr. Walter Roberts of Los Angeles asked Dr. Jeancon about the available statistics from Australia, which indicate that 100 percent of the women who have rubella in the first two months will give birth to babies with congenital cataracts and other congenital anomalies. He stated, however, that he had seen one case in which a woman was proved to have had rubella, but the infant was born normal.

Dr. Irvine brought up the question as to why these babies get cataracts.

Dr. Alfred Robbins, in turn, asked whether this disease really is rubella. He discussed the embryology of the lens and showed slides indicating the various stages of its development during the first few week of embryonic life. He considered that any disease in early pregnancy may cause such congenital anomalies in the eye, and urged caution in making any resolutions officially, saying that there is plenty of time to observe this syndrome to determine what its true nature really is.

Dr. Dennis Smith of Long Beach stated that he believed this to be another manifestation of an ectodermal disease.

Dr. Alexander Ray Irvine, Jr., asked why other diseases might not as well cause congenital cataracts. He discussed the relationship between rubella and fibroplasia, and stated that this also fitted in with the congenital heart lesions.

Dr. Albaugh asked why some of the patients do not have all the manifestations; that is, all the congenital anomalies. He wondered why some had heart disease, some had congenital cataracts, and some might have both, while still others might be deaf mutes.

Dr. John P. Lordan, in reply to the question, what are the differential points concerning the lens in the absence of a history of rubella in such types of cataract, said that a nuclear cataract with a typical complication, such as heart disease and deaf-mutism, is the answer.

Dr. Robbins stated that he was not so sure of the diagnosis; that he had seen four such cases, none with identical pathologic changes in the lens.

Dr. A. Ray Irvine reported a case from his practice in which there was a definite cortical cataract which was similar to a traumatic one.

Dr. Dennis Smith related the case of one of his patients who had been a premature infant and whose mother had had rubella in the early weeks of pregnancy. There were typical signs, such as cortical opacity and cloudiness of the cornea with congenital heart disease. He stated that at first the anterior chambers were not shallow; that the corneal opacity cleared. Later the whole lens became opaque and the cornea became edematous. Congenital glaucoma followed several weeks later.

Dr. John P. Lordan discussed his ideas of the therapy of such cases. He stated that, in the first place, these infants were supposed to be more atropine sensitive than are normal children. He felt that this was not the case—it was simply over-dosage and not a specific sensitivity.

Most of these babies, he said, are underdeveloped and will not tolerate so much atropine as the normal child. On the whole, he thought that little could be gained by very early surgery because the pupil could not be dilated well.

Dr. Robert A. Norene stated that he had never had any difficulty with dilating the pupils in these patients, but that he had not used atropine. He found that neosynephrin was efficacious. He cautioned that it should be used carefully, in as much as the babies who had associated congenital heart disease might react excessively to a cardiac stimulant.

Dr. Warren Wilson stated that the diagnosis of rubella could be very easily overlooked. He discussed an epidemic he had seen, in which the cases were diagnosed as sore throat for some time before it was realized that it was an epidemic of true rubella. He said many of these patients go first to the Ear, Nose and Throat Clinic and are missed as rubella.

Dr. Welch of Glendale suggested that everyone be inoculated with both measles and German measles in childhood.

Dr. Dennis Smith wished to know about the optimum time for surgical intervention.

Dr. Mel Trainor stated that he always operated in these cases within the first year, and, if a needling was not done, he performed an optical iridectomy in order to give stimulation for development of the macula.

It was the consensus of the members of the staff that early operation is indicated in order to develop the macula properly.

Dr. Alfred Robbins stated that he operates as soon as possible. He also reported that the pupil dilates well with neosynephrin. He uses a special technique of his own in which he opens the anterior capsule of the lens and sucks out the corti-

cal and nuclear material with a special device of his own design. However, he is cautious about surgery from the standpoint of an anesthetic. He always waits until the pediatrician indicates that the child is in condition to stand general anesthesia.

Dr. John Lordan initiated a discussion of other congenital defects following rubella in early pregnancy. Among others, he had had several cases of buphthalmos. He felt that the mechanism was somewhat as follows: if the tissues around the angle are disturbed in early pregnancy by the process involved in rubella, the normal atrophy which leaves the trabecular network cannot take place, with the result that the canal of Schlemm and its mechanism are not developed. He believes that the procedure of Barkan—namely, anterior sclerotomy or goniotomy—is the indicated surgery.

Dr. A. Ray Irvine agreed with him and stated that he felt Dr. Barkan's results were 40 to 50 percent cures.

Dr. Endres stated that in his opinion it was economically impossible to send many of these cases to Dr. Barkan in San Francisco and that someone in Los Angeles should cultivate such a technique.

C. H. Albaugh,
Reporter.

MEMPHIS SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

June 19, 1945

DR. M. B. SELIGSTEIN, *presiding*

CONGENITAL STENOSIS TREATED BY PLASTIC DACRYORHINOSTOMY

DR. RALPH O. RYCHENER reported on Larry G., aged two years, who was first seen on December 18, 1942. Congenital stenosis of both eyes, had been observed

soon after birth, but treatment was delayed until June, 1941. Two months later fluid passed through the right duct and this eye gave no further trouble. However, stenosis persisted on the left side, despite 80 probings by a local colleague. On inspection, a large mucocele was found in the left sac with no evidence of infection. A double-0 probe was passed into the canal, an imperforate lumen ruptured, and fluid then passed freely into the nose. The duct remained open for a week, but, following an acute rhinitis, obstruction developed, and it was not possible to reopen the lacrimal passage thereafter. On June 19, 1943, a plastic dacryorhinostomy was accomplished, with permanent relief of symptoms.

Dr. Ralph O. Rychener reported a second case of congenital stenosis for which dacryorhinostomy was performed. F. C., aged five years, was referred to him on February 4, 1942, by Dr. A. D. Frost of Columbus, Ohio. Congenital stenosis was noted early, but treatment was not instituted until the child was 21 months old, when probing with the giant probe, after slitting of the canaliculi, was done. Although fluid could be forced through the passage into the nose, retention mucoceles persisted, and there was a constant lacrimation and backwash of purulent material into the conjunctival cul-de-sac.

Mucoid material could be regurgitated by pressure over the lacrimal sacs, and injection of iodochloral showed by X ray that the sacs measured 3 by 6 mm. and 5 by 10 mm., respectively. Fluid could be passed through the right sac under moderate pressure.

Under ether anesthesia, plastic dacryorhinostomy was done on the right sac, on February 11, 1942, and on the left sac, February 14th. The first operation was uncomplicated, but the second involved a cavernous plexus in the lacrimal fossa, resembling a hemangioma from which

there was considerable loss of blood. It was also necessary to extenterate some accessory ethmoid cells before the nasal mucosa could be reached. Glucose—175 c.c of a 5-percent solution—was given intravenously. Postoperative convalescence was uneventful. Fluid passed freely through both sacs by the sixth postoperative day. A letter from the parents on December 18, 1943, reported that both eyes were dry and giving no further trouble.

PIGMENTARY DEGENERATION OF THE RETINA WITH CATARACTS AND DEAFNESS

DR. PHILIP MERIWETHER LEWIS presented a white woman, aged 38 years, who had noticed for two years that her vision was failing.

Examination showed corrected vision to be: O.D. 10/200 and J10; O.S. 20/100 and J8. Immature nuclear cataracts were present in both eyes, but the visual fields were badly contracted, and the projection of light faulty. On dilating the pupil, an atypical form of pigmentary degeneration was found. The patient was

also quite deaf and had been all of her life. She has two normal children, a boy of 11 and a girl of 9 years. During a pregnancy, two years before, she thought that her vision became much worse. This child lived only a few months. The cause of death was unknown. The patient's general condition and blood were normal.

Three other members of her family were examined. One brother and one sister, aged 45 and 43 years, respectively, had pigmentary degeneration of both eyes and also deafness. One sister, aged 49 years, had normal eyes and good hearing. One brother, aged 41 years, lived too far away to be examined, but was reputedly normal. The parents had been killed simultaneously by accident in their middle fifties. Both had had good sight and hearing; they were not related.

The question in this case was whether or not to remove the cataracts. In view of the bad prognosis and the likelihood of complete blindness eventually, it was thought that operation was contraindicated as long as the patient had any useful vision.

AMERICAN JOURNAL OF OPHTHALMOLOGY

Published Monthly by the Ophthalmic Publishing Company

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NATIONALIZED OPHTHALMOLOGY IN BRITAIN

The Labor Government in Britain has been in power a little over nine months and is now in the throes of giving birth to the National Health Service Bill; and, although it is not yet law, it is already clear what the general outline of the new socialized medicine will be. For better or for worse, the whole aspect of British medicine is to change. No one who knows it and its shortcomings, particularly in the rural areas, will deny that many

changes would be desirable. It may be of interest to American readers to know what is contemplated, for—who knows?—a similar fate may some day descend upon them.

From the point of view of the people, all medical facilities, both hospital services and personal medical attention, are to be offered "free" to any citizen who wishes to avail himself of them—that is, free to the sick person at the time, and paid for as a national charge, partly from a universally levied weekly insurance and

partly from general treasury funds. Incidentally, the insurance also provides birth allowance, children's allowance, sickness allowance, unemployment allowance, old-age pension, and provision for funeral expenses.

In general terms, from the administrative point of view, medicine is considered in two parts: the general-practitioner service and the hospital and specialist service; into the latter comes ophthalmology. All the hospitals of the country are to be taken over by the State, and the country is to be divided into some 16 or 20 regions, each of which is centered upon a university teaching school. Each of these regions is to be administered by a regional hospital board appointed by the Minister of Health, and their function is to coördinate and administer the specialist services in its area and lay down general lines of policy, the day-to-day administration of individual hospitals or groups of hospitals being delegated to local committees appointed by them. It is proposed to have a full and regionally planned hospital and specialist service available throughout the entire country: each hospital, whether rural or urban, whether previously wealthy or poor, will have comparable material facilities and comparable financial resources. Although they must conform to the general plan of hospital services designed by the regional boards, the teaching hospitals are to be allowed to retain a certain degree of individuality, since they are to be administered by separate boards of governors and may individually retain their endowment funds.

Ophthalmologists, as other specialists participating in the National Service, will thus be appointed by and in the employment of the regional boards (or the boards of governors of teaching hospitals). The whole of the practice of ophthalmology is to be institutionalized.

Consulting and operating work will take place in the hospitals. The routine eye-testing and the provision of spectacles must, for obvious reasons, be more fully disseminated among the population, and these are therefore to take place not only in the hospitals but also in a large number of satellite clinics administered by them, functioning on a whole-time or part-time basis, depending on the needs of the locality. These clinics are to be staffed by an ophthalmic specialist, junior ophthalmologists under him (in the larger clinics), and, also under him, optometrists (sight-testing opticians) will do the bulk of the refractions. Spectacles will be obtainable ("free") at the clinic or at the shops of dispensing opticians who contract in to the service, but if they are broken or lost as the result of carelessness or if the patient chooses to be supplied with more expensive spectacles than those issued by the State, he will be expected to meet the additional cost involved. Until the clinic system becomes materially possible (and this in many districts will take some considerable time owing to lack of suitable buildings), as an interim measure the present system will virtually be carried on—patients will have a free choice of going without fee for refraction examination either to an ophthalmologist (at a clinic or his office) or an optometrist (at his shop).

A feature of the scheme of peculiar interest is the new relationship contemplated between ophthalmologists and opticians. It is quite obvious that in no measurable time could all the refraction work be done by medical men: no ophthalmologist in Britain today is idle, and yet some 75 percent of the refractions in the country are done by optometrists, and a universally "free" service will undoubtedly increase the demand very materially. Furthermore, it would not be economic that 10 years of training (the time which

will probably be demanded for the total training of a specialist) should be required for the routine examination of the optical state of all eyes, the vast majority of which are free from pathologic change. The ultimate arrangement, whereby all optical examinations are conducted under medical control, appears to be the most adequate arrangement possible, the junior ophthalmologist, the optometrist, and the orthoptist being supervised by the surgeon in charge of the clinic. Initially, in order to avoid hardship, it is the government's intention to employ in this way all adequately qualified optometrists on a rota system if necessary; the suggestion is that new entrants to the profession, however, will be required to become either whole-time "refractionists" or whole-time "dispensing opticians" so far as the State service is concerned. In the past, there has probably been as little love lost between ophthalmologists and opticians in Britain as in America, but it may be that when both parties fall into an allotted role the animosities of the past will be lost in coöperation in the future.

Where will all these changes lead British medicine? That is a question which today is very difficult to answer, and the reply will almost certainly vary with the political leanings of the individual. It may be argued that it is wrong that the care of the poor when they are sick should depend on the charity of the rich, that this should fall as a duty upon the community as a whole, and that the voluntary system allows many to escape their social obligations. It is true that hospital services and specialist facilities should be organized over wide natural areas and not confined to the capricious boundaries of local government or conditioned by the attractions of wealth or social amenities. It is certainly true that in the poor community, or the wealthy, an equally complete and efficient hospital

service should be readily available for all. Moreover, as wages and prices rise and medicine becomes increasingly loaded with complicated equipment, the voluntary hospital must look forward with anxiety to a future wherein gifts are limited by unprecedented taxation and legacies are rendered almost impossible by death duties of confiscatory dimensions.

There are certainly many arguments which are difficult to confute in favor of such a national service, and many good points in the proposals outlined in the bill. On the other hand, there is a deficit account, and those who have been brought up in the spirit of a voluntary hospital cannot but have many misgivings. Will the loss of the local interest and local responsibility which gave individuality and vitality to the voluntary hospital be compensated by increased efficiency in a huge bureaucratic mechanism directed from afar by government servants, with the inevitable lack of elasticity which this must entail even in the most gently guided State scheme? Is the wisdom, the capacity, or the humanity of the State so great as to outweigh personal intimacy and interest and to justify a State monopoly of hospitals? There may be a gain in the technical machinery and financial resources available to medicine, but, unless the treasury changes the habits of centuries, will this carry with it individual frustration and submergence in administrative regulations? Time will show. Those of us who have served in the army may be able to suggest an answer. The administrative success of the scheme will depend in very large measure on the amount of decentralization allowed, on the wisdom of the regional boards, and on the degree of local financial freedom permitted within the limits of a reasonable budget.

So far as the ophthalmologist is concerned he will, to the extent to which he

participates in the service; receive the security of a regular pay-packet from the beginning of his professional career and a pension at the end in exchange for the adventures of private practice with its risks and possibilities; he will be deprived of many opportunities of doing much without material reward, but will incidentally be less his own master than formerly. So far as medicine (and ophthalmology) is concerned the new plan will be good in the final assessment only in so far as it can continue to attract brilliant young men and reward them sufficiently, and only if they have ample opportunity for initiative and the full expression of their personalities; there are few glittering personalities without glittering rewards, and medicine will be in competition with other comparable professions which as yet are not nationalized and may provide more individual scope.

It is anticipated that the present bill will become law in the early fall and that the national service will start to function in the beginning of January, 1948. It will then be necessary for each practitioner to decide whether or not he will take part in the service, either whole time or part time; but it is difficult for the consultant not to be at least a part-time participant; since all hospital facilities will belong to the State. With the present relations between the public and the profession, private practice will undoubtedly continue so long as the present generation lives. Everyone pays education rates in England, yet many send their children to Eaton. But social ideas change, and with heavy social levies double payments become more difficult. Certainly the danger potentially exists of the gradual abolition of private practice and the ultimate development of a State monopoly of medicine: the avowed aim of the Labor Party is a full-time State-salaried service "when the time is ripe." With State con-

trol of all hospitals, such a development would be easy, and very wide powers are to be vested in the Minister of Health—whoever he may happen for political reasons to be. This, accompanied as it would be by the greatest black market of all time, would, I think, be a tragedy for British medicine. As a whole, doctors today have the interests of medicine at heart; but whether the type of man who will be attracted to a State service in the future will be equally enthusiastic is another matter. On this will depend in part the ultimate success of this social experiment. In part it will also depend, unfortunately, on factors quite outside the control of medicine which hitherto have not always been uniformly dependable—on the wisdom of politicians and the understanding of civil servants.

Sir Stewart Duke-Elder.

OPHTHALMOLOGY SCORES AGAIN

It is a matter of common knowledge that ophthalmologists are modest, retiring fellows, and loath to praise themselves. This commendable trait can be overdone. Thus, no one has seen fit to applaud the course just launched by the Ophthalmological Study Council, so it falls to us to commend this last achievement of our specialty.

We are not alone in the emergency that instigated this project. All the medical specialties were faced with a 5-years' supply of candidates for special training disgorged by the Armed Forces. In ophthalmology there were opportunities to accommodate less than the normal quota of men for a single year. Their preparation falls roughly into three different categories: One group had had no special training, but was headed toward ophthalmology when taken into service; another had started special study, but was not

established in practice; a third was in practice before the war but wished for refresher courses. Most men in all groups were either contemplating the examinations for the certificate of the American Board of Ophthalmology, or had already tried them and been found wanting in some or all subjects. Consequently, they were desperately bombarding the Board with impatient letters inquiring into two problems. These were, first, how much credit the Board would allow for Army and Navy service. The reply to this was wholly unsatisfactory. The Board gave credit only for ophthalmologic experience so obtained. Because much of the service with the Armed Forces entailed no such experience, this led immediately to the second question, which was how the Board justified its position in establishing standards which could not possibly be attained by the great majority of the candidates under existing conditions.

While the Board was adamant as to the qualifications to be recognized as indicating competence in ophthalmology, they had to admit that there was some justice in this complaint. The Board itself does not intrude directly into the teaching field, beyond making every reasonable effort to stimulate existing teaching institutions. In this emergency the response was prompt and effective. The larger universities and hospitals readily agreed to increase their students and residents, often doubling and more than doubling the numbers. Many leaders in practice were willing to act as preceptors, especially for young men who had had residencies and basic courses. But after all these opportunities had been utilized, the Board was still swamped by applications of men who could obtain no places, most of them veterans who had made considerable sacrifice for the general good.

This was the situation when Prof. Ida

Mann, who was guest of the American Ophthalmological Society at its Hot Springs session, in November, 1945, described the training course in use in England for men in service. It was a sort of mass production basic course. Pathology, to illustrate, was not administered to a few lucky students with microscopes, but was taught to large classes by throwing sections on the screen with a lantern.

This seemed to offer the logical solution to the problem, but, on proposing it, there were more reasons for delay than obstructed the invasion of France during the war. The very fact that the hospitals and schools had generously overextended themselves in this cause, prevented them from undertaking anything additional, especially such a novel experiment as this.

So at the end of the year the secretary of the Board was unexpectedly invited to a conference in Boston with Dr. Walter B. Lancaster and Dr. Theodore L. Terry. It was a carefully planned meeting, evidently not so impromptu as it seemed, and, somewhat to the surprise of all, it reached a decision to offer a course in the basic subjects of ophthalmology in Boston, during April and May of 1946. It was believed that if the course were to be of use it must proceed at once, and four months seemed the shortest time in which arrangements could be made. In view of the foreseen and unanticipated obstacles that were encountered, this interval was decidedly brief.

Now is a good time to answer the inquiries from colleagues contemplating a similar course, as well as from teachers in other specialties. The detail was enormous. Either because of it, or coincidentally, Doctor Terry fell by the wayside and was sent to the hospital, and then away to convalesce. Not, however, until he had made his contribution to the organizing. The work then fell upon Doctor Lan-

caster. Possibly the launching of the course on time was due to having a one-man committee able to make instant decisions. The result was that Doctor Lancaster was also laid up, just as the course began. Only the versatility of a few secretaries prevented a traffic jam on registration day.

Perhaps a brief review of the arrangements required will reduce the casualties among future organizers. Without attempting a blow-by-blow report, one may say that these are the main headaches. First, where would such a course, having no hospital or medical-school backing, be given. At this time, the venture did not even have the renowned shoestring, which has so often brought success. Fortunately, the hall of the Boston Medical Library was available, and the managers made no embarrassing inquiries about the solvency of the course. Then, many of the local teachers, who would normally have been asked to teach, were already under contract to the extra session of the 4-months' basic course which the Harvard Graduate School of Medicine had organized in response to the pleas of the Board. So faculty must be in considerable part imported. This seemed at first likely to be as difficult as getting nylon stockings, but it turned out to be the least of our troubles. No one refused. The finances required much more maneuvering. The obvious source of support was the Veterans' Administration appropriation under the G.I. Bill of Rights. The authorities, however, were canny, and required unshakable proof that the G.I. was not going to be swindled by either shysters or visionaries. If funds were to be authorized, incorporation and approval of the proper authorities of the Commonwealth of Massachusetts must first be forthcoming. So an imposing group of incorporators had to be enlisted. This offered no particular difficulty, but took much valuable time. Fur-

ther confidence was built up by inviting an advisory board of outstanding teachers.

An unexpected problem arose in the housing and nourishment of a large group like this. At that time, Boston doctors were unable to obtain rooms for single patients who wished to consult them. The hotel association could not promise any accommodations for such an indefinite number of men, many with families. They did, nevertheless, find a summer hotel some 20 miles out, which was willing to open a couple of months early, and offered reasonable rates. This method required a bus service to get the students to and from classes, and their wives to and from stores.

In the meantime a curriculum had to be determined, hours assigned, and teachers fitted to the hours, or hours to the teachers. With many of the most illustrious faculty as far away as Baltimore and Chicago, this would have made a complicated job even for a veteran train dispatcher. It was decided to hold sessions morning, afternoon, and evening. While this seems to exceed union hours, in practice it was not too arduous. Lectures were limited to five or six a day. Considerable rest periods, quizzes, and examinations were interspersed. Usually the week ended Saturday noon.

One problem common to all such courses is as unsolvable as uniting the United Nations. That is adapting such instruction perfectly to the needs of such diverse groups, one of which had never had any ophthalmology; another with considerable knowledge of the fundamentals; and a third with a varying amount of actual practice. To complicate this situation still further, textbooks were entirely unavailable, and would not be issued until sometime in the summer. Thus more textbook material would have to be repeated in the lectures than would usually

have been the case. This necessitated some method of reproducing the lectures of those instructors who spoke without notes. Stenotypy, which has been used in some refresher courses, was too expensive. Ediphone equipment was therefore purchased, and hooked up with the broadcasting apparatus in the hall. This necessitated obtaining secretaries to transcribe the records, no mean task with the shortage.

The result of this hastily organized project was better than could have been supposed. That some "bugs" would creep into such a novel scheme is inevitable. They were not always the ones that were foreseen. New England weather had to live up to its reputation. An untimely blizzard hit the area in April, to extend its welcome. Consequently the men on reaching their hotel on registration day found their families almost rigid with cold in an inadequately heated summer hotel. Many at once sought quarters in Boston though not always what they would have chosen. Then, in response to questionnaires, it seems that more concentration in the daytime, and no lectures in the evening would have been more popular. As would be expected, beginners felt that "too much was taken for granted" and experienced men called some elementary work "sophomoric." Now that textbooks are again available, this last objection could be avoided in a later course.

At \$200 for the course, the cost was about \$25 a week, which is probably too little. It gave the organization, with between 75 and 100 students, an income of over \$18,000, which just about covered expenses, allowing a modest recompense to the lecturers.

The general attitude was favorable. In fact the demand for a repetition is such that a similar course is projected in Florida during November and December. This does not necessarily mean that it will be-

come a permanent institution. It was planned as an emergency measure to meet the immediate need, in which, as usual, ophthalmology has pioneered.

S. Judd Beach.

IRIDENCELEISIS AND TENON'S CAPSULE

Almost forty years ago Holth of Christiania (now Oslo) published what must be regarded as one of the classics of ophthalmic literature, under the title of "Iridenceleisis antiglaucomatosa" (*Annales d'Oculistique*, 1907, volume 137, page 345; originally presented in 1906 to the Medical Society of Christiania; also in condensed form to the French Ophthalmological Society and to the German Ophthalmological Society in Heidelberg). Holth's paper is a model of clear thinking and patient observation.

Except as to iridectomy, proposed by Graefe for the relief of glaucoma fifty years earlier, previous operations against glaucoma had aimed to establish a new channel of drainage of aqueous humor by excision of sclera beneath a conjunctival flap. Holth's operation, generally speaking, excises no tissue; and it depends for a successful result upon the formation of a new drainage channel associated with incarceration of the pigmented iris between the lips of the scleral wound.

Two or three years before publication of Holth's paper, the study of glaucoma had taken a great step forward with the introduction of the successful tonometer of Schiötz, another Christiania leader. Holth had tested with the tonometer a series of glaucomatous eyes which had been subjected to iridectomy. Except within the first few weeks after the operation, he found the intraocular pressure generally above normal. Strangely enough, and in spite of the dread of iris

prolapse as a dangerous complication following any intraocular operation, Holth learned that the iridectomized eyes which had been relieved of their hypertension were usually eyes in which the technique of the operation had been regarded as defective in that iris tissue had been left in the scleral wound.

Holth therefore made an intentional experiment upon the two equally hypertensive eyes of the same patient (54 mm. Schiötz), doing an ordinary iridectomy upon the blind eye and on the other eye an iridectomy with incarceration of the iris beneath the conjunctival flap. In the former the tension fell to 43 mm., in the latter to 24 mm. Comparison of other cases of accidental incarceration with cases in which the iridectomy had been classically performed supported the conclusion that the subconjunctival incarceration was beneficial instead of harmful. Holth therefore proceeded in a number of cases to perform iridectomy with intentional incarceration, and his original article reported a goodly series of excellent results.

The technique of iridencleisis has undergone various modifications at the hands of different surgeons. Holth himself preferred a keratome incision, picking up an 8- or 10-mm. conjunctival flap, pushing the keratome along the sclera to within a bare millimeter of the limbus, and then drawing the iris sphincter into the scleral wound and making a meridional cut to one side of the forceps. Others have made the incision with the Graefe knife, although Holth had tried this method and did not favor it. Some surgeons have worked through a small conjunctival opening made with a Graefe knife. Occasionally, operators have dissected a conjunctival flap from the limbus peripherally (Van Lint flap). Some have performed the usual type of iridectomy, but leaving iris tissue in each angle

of the scleral wound. Others have combined iris incarceration with excision of sclera as recommended by Lagrange.

Reese (*Archives of Ophthalmology*, 1945, volume 34, page 360) has lately urged the same type of keratome approach as originally advised by Holth; succeeded by the making of traction on the pupillary margin at two points (by operator and assistant synchronously) until a dialysis is produced between the two points of traction; and lastly division of the iris at right angles to the pupillary margin, followed by incarceration of each pillar of the iris into an angle of the wound.

Approval or disapproval of the iridencleisis operation by the individual operator seems to have varied greatly according to his previous preference for other operations (the Lagrange or the Elliot especially), or according to the custom of surgeons in the same part of the world. No doubt an important influence has come from initial experience in performance of the operation, especially such experience as might depend upon misconception or preconception regarding technique of anesthesia or of the operation itself.

Downright opposition to the operation has been manifested by some surgeons. Torres Estrada (Mexico), for example, speaks very strongly against every fistulizing operation, and practically always performs a very extensive cyclodialysis to which he has applied the title "hemicyclodialysis" (*Boletín del Hospital Oftalmológico de Nuestra Señora de la Luz*, 1946, January-April, page 121). A few eye surgeons have had the misfortune to see one or two cases of sympathetic ophthalmia following filtration operations, including iridencleisis.

It maybe that, in discussing the technique of iridencleisis as well as the occasional failures following this operation,

we have paid too little attention to the anatomic and physiologic relations of Tenon's capsule. In describing the operation, reference is often rather loosely made to dissection through subconjunctival tissue down to the sclera in the vicinity of the limbus. Holth himself makes no direct statement in this regard. His insistence on use of the keratome rather than scissors in executing the preliminary incision may have a bearing on the subject, especially when considered in relation to his description of a keratome incision which penetrates the conjunctiva 8 or 10 mm. from the corneal margin, and then drags the conjunctival fold along the sclera to enter the eye a scant 1 mm. above the limbus.

Peters's chapter on diseases of the orbit in Axenfeld's *Lehrbuch* (seventh edition) regards the space between Tenon's capsule and the sclera as a lymph space which continues into the supravaginal lymph space of the optic nerve and is also connected with the suprachoroidal space of the eyeball. Some doubt has been cast upon the existence of such anatomic continuity.

In dissecting back a conjunctival flap for cataract operation, it is a matter of common note that the subconjunctival tissue (in Tenon's capsule) of this region varies greatly, being sometimes well defined as a special layer and sometimes less definite. But usually, after incising the conjunctiva, it is possible with care to pick up a delicate but distinct layer of fibrous tissue which may then be incised as a unit and so separated from the sclera as far as the limbus.

Meller, disapproving of iridencleisis on general principle, repeatedly avoided mentioning it in his "Ophthalmic surgery." Sweet's third American edition of the same work (from Meller's second edition) gives an account of the iridencleisis operation but makes no mention of

Tenon's capsule in this connection. The same is true of Spaeth's "Ophthalmic surgery."

Many surgeons have approached consideration of the iridencleisis operation with a definite prejudice against it, and have never been converted from this prejudice. The present writer's experience with the operation (which he first used in December, 1928) has usually been gratifying, and he is disposed to believe that some failures have been, at least in part, due to insufficient care in separation of Tenon's capsule as an anatomic unit.

Holth's very definite success in applying this procedure to a number of cases of absolute glaucoma, with tension as high as between 60 and 70 mm. Schiötz (in spite of miotics) and also as a second operation after failure or incomplete success of iridectomy, has been shared by other operators. Use of iridencleisis after an acute exacerbation of chronic glaucoma should probably be resorted to only after beneficial reduction of tension by paracentesis.

W. H. Crisp.

BOOK NOTICE

CLINICAL OPHTHALMOSCOPY.

By Arthur J. Bedell, M.D., F.A.C.S., D.Sc., LL.D. 200 glass mounted Kodachrome 2 by 2 inch reproductions with a concise history and a description of each. Distributed by James A. Glenn, 76 Columbia Street, Albany, New York. Price \$100.00. 1946.

It has been a rare privilege and a great treat for the reviewer to be able to view these slides, leisurely projected as these were meant to be, where the full beauty and the remarkable stereoscopic illusion could be fully enjoyed. Each slide beautifully discloses details that minutely express the condition. Natural colors are

faithfully reproduced, enhanced by the expertly sharp focus. The series has been carefully chosen to illustrate most of the ocular-fundus conditions that are met with in ophthalmoscopy. The collection is of great value to the teacher and should be available to all students for study and review.

The collection begins logically enough with a few slides of the normal fundus and its variations. It progresses through various pathologic conditions, each of which is illustrated with two or more slides, to end with fine photographs of a "before and after" case of an intraocular foreign body.

There are many serial pictures of the same patients taken at different intervals, some over a period of several years. Thus an unusual opportunity is afforded to trace the evolution of different disease processes and to compare one phase with another. The instructive series of slides illustrating the various grades and stages of development of retinal arteriosclerosis, vascular hypertension, and diabetic retinopathy are especially noteworthy. Their value as teaching aids in explaining and understanding this difficult subject is obvious. Another example of the teaching value of interval pictures can be readily appreciated on viewing the series of macular retino-choroiditis up to the healed stages.

It is difficult to pick out the most outstanding photographs. All are good and many are worthy of exclamation. There are no failures and few disappointments. In some of the photographs the white spots, representing the reflex from the carbon arc, have been painted out. The author points out that these should not be misinterpreted as localized pigmentation, a very real danger. It is questionable whether anything has been gained by obliterating the reflex, for the remnants are always visible. However, in one case,

that of a photograph of a detached retina, the painting out of the carbon reflex has undoubtedly enhanced the effectiveness of the slide. It is curious, too, not to see pigment deposits, for example those of retinitis pigmentosa, stand out as black as they do in life. But these are exceedingly minor flaws and are not worthy of being dwelt upon.

It is unnecessary to explain to the reader who Dr. Bedell is. His fame as an ophthalmologist and photographer of the ocular fundus is world wide. Those who have not had the chance to hear him and see his pictures at the meetings for the past many years now have access to an unsurpassed collection of what are no doubt the prizes of his many years of work.

Now if some well-known ophthalmic pathologist will provide us with a similar set of Kodachrome slides that illustrate the pathology underlying each of the Bedell reproductions, the heart of the teacher will be exceedingly happy.

The Bedell Kodachrome slides are carefully mounted in glass, numbered, and distributed in two gray, metal slide boxes with handles. A good description of each slide, covering the essential points of history and condition, is printed and bound spirally between paper covers and accompanies the collection.

Derrick Vail.

CORRESPONDENCE

POSTGRADUATE INSTRUCTION IN OPHTHALMOLOGY AT HARVARD MEDICAL SCHOOL

To the Editor,
American Journal of Ophthalmology:

In the May, 1946, number of the American Journal of Ophthalmology appears an excellent editorial by Dr. Crisp entitled "A national program for training

in ophthalmology." In commenting on the postgraduate courses given at Harvard, Dr. Crisp states, "These short programs should be stimulating to young ophthalmologists whose time was badly wasted during the war, and who are eagerly looking for refresher courses. By themselves, the two Harvard courses cannot, it is obvious, create first-class ophthalmologists."

With this I agree wholeheartedly, and lest anyone might infer from the editorial that it is the intention of the Department of Ophthalmology at Harvard to create ophthalmologists by short courses, I wish to state that just the opposite is true. These two courses were given earlier than usual, and in condensed form, to help fill the tremendous demand for instruction on the part of the returning medical officers, but they were designed primarily for young doctors wishing to take didactic work as a preliminary to their residency. Selection of candidates was carefully made on the basis of previous education and future intentions, and no one (except recognized ophthalmologists) was allowed to take the clinical course without first having had the course in fundamentals.

We believe that a residency in ophthalmology is the only proper way to obtain adequate training in this field, but that a course in the basic sciences should be a prerequisite to such a residency. This basic-science course is necessary to bridge the gap between the deficiencies of undergraduate medical-school training in ophthalmology and the clinical work in the residency.

We feel sure also that the fundamentals cannot be taught by lectures, reading, and quizzes alone, as some have contended. Laboratory work is essential, but it is questionable whether this type of basic instruction can be given properly by the average clinical ophthalmologist. In most

instances it is better done by the full-time research staff attached to an ophthalmic center.

The policy of the Department of Ophthalmology of Harvard Medical School is to give two types of postgraduate instruction: (1) A basic-science course of three months' duration given by the staff of the Howe Laboratory of Ophthalmic Research to young physicians who are going to take a residency in ophthalmology. (2) Refresher courses in clinical subjects given by clinicians and open only to recognized ophthalmologists who have already had an ophthalmic residency.

(Signed) Edwin B. Dunphy, M.D.
Clinical Professor of Ophthalmology,
Harvard Medical School.

DISPENSING WITH BIFOCALS

Editor,
American Journal of Ophthalmology:

Apropos of Dr. Pascal's remarks on "Dispensing with bifocals" in the May, 1946, issue of the American Journal of Ophthalmology, it may be interesting to report a case which bears out the feasibility of so doing to even a greater extent, at least in selected cases.

While in Belgium, I had known and had some contact with Prof. Allvar Gullstrand, who was wearing bifocals in which each lens was adapted for two different distances for the corresponding eye; that is, the bifocals gave Dr. Gullstrand four monocular regions of clear vision with binocular fixation. This case illustrates what can be done along this line in providing two full monocular fields of vision with a pair of differently adapted single-vision lenses.

(Signed) Georges Kleefeld, M.D.
115 Central Park West,
New York, New York.

ABSTRACT DEPARTMENT

EDITED BY F. HERBERT HAESSLER, M.D.

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

- | | |
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| 1. General methods of diagnosis | 10. Retina and vitreous |
| 2. Therapeutics and operations | 11. Optic nerve and toxic amblyopias |
| 3. Physiologic optics, refraction, and color vision | 12. Visual tracts and centers |
| 4. Ocular movements | 13. Eyeball and orbit |
| 5. Conjunctiva | 14. Eyelids and lacrimal apparatus |
| 6. Cornea and sclera | 15. Tumors |
| 7. Uveal tract, sympathetic disease, and aqueous humor | 16. Injuries |
| 8. Glaucoma and ocular tension | 17. Systemic diseases and parasites |
| 9. Crystalline lens | 18. Hygiene, sociology, education, and history |
| | 19. Anatomy, embryology, and comparative ophthalmology |

4

OCULAR MOVEMENTS

Smart, R. E. The diagnosis and treatment of ocular muscle anomalies, Canadian Med. Assoc. Jour., 1946, v. 54, April, p. 371.

The author outlines the diagnostic procedure which he considers essential in the study of the functions of the extraocular muscles. It consists of six steps; namely,

(1) Measurement of the near point of convergence. (PcB)

(2) Maddox-rod test (with screening) at 20 feet, and at 14 inches. These first two tests are used to determine whether the anomaly is one of convergence or divergence, and if it is an excess or an insufficiency.

(3) Ocular excursions in the six cardinal directions.

(4) Screen comitance test in the cardinal directions.

(5) Cover test (with prisms) at 20 feet, and at 14 inches; then, in the cardinal positions at 14 inches. These three tests enable one to determine

whether or not a heterophoria or heterotropia is concomitant; if it is not, they enable one to identify the paretic muscles involved.

(6) Accommodation is tested with Prince's rule.

In addition to these tests, vergence tests may be necessary. At times, a prolonged monocular occlusion is of value in eliciting a heterophoria.

The question of treatment of muscle anomalies is touched upon. Emphasis is placed on the need for an accurate muscle diagnosis in the proper care of the eye patient. Benjamin Milder.

Wincor, H. G. Method of measuring and placing recession sutures. Amer. Jour. Ophth., 1946, v. 29, May, pp. 585-587.

5

CONJUNCTIVA

Bietti, G. B. Action of penicillin upon the inclusion bodies in trachoma. Studi Sassarese, 1945, v. 23, no. 1, pp. 3-7.

Bietti studied the effect of penicillin

on inclusion bodies from 10 cases of recent trachoma, since this seemed the best test of the activity of the antibiotic upon the virus. Collyria containing 100 to 20,000 units per cubic centimeter were instilled every two hours. One eye only of each patient was treated, and smears were made daily from both eyes. Within 24 to 48 hours the corpuscles showed marked morphologic changes, and in 48 to 72 hours the initial bodies and the inclusion bodies had disappeared. The action of penicillin was not, however, more effective than that of the sulfonamides and did not clear up the nodules more rapidly.

Eugene M. Blake.

Bietti, G., and Scalfi, L. The sensitivity to penicillin *in vitro*, of typical conjunctival bacteria. Studi Sassarese, 1945, v. 23, no. 1, pp. 3-4.

The writers isolated 51 cultures of nonliquefying *Staphylococcus albus*, 12 of liquefying *Staphylococcus albus*, 13 of *Staphylococcus aureus*, 34 of diplobacillus, 24 of *B. xerosis*, and 6 of Koch-Weeks bacilli. The organisms were grown in agar, broth, Loeffler's serum, and blood agar, to which penicillin had been added in concentrations of 0.01 to 5 Oxford units per cubic centimeter of culture medium. *Staphylococcus* was found most sensitive to the drug, with very little difference between the three types. Next in order was *B. xerosis*, then the Morax-Axenfeld diplobacillus. The Koch-Weeks bacillus was practically unaffected. The most striking result of the study was the fact that the diplobacillus, a gram-negative organism, was consistently sensitive to penicillin.

Eugene M. Blake.

Bietti, G. B., and Pegreff, G. The Weil-Felix reaction in keratoconjunc-

tivitis epizootica and in trachoma. Boll. Soc. Ital. di Biol. Sper. 1942, v. 18-21, pp. 1-2.

Coles and others have found rickettsia in the epithelial scrapings from the conjunctiva of birds in a certain form of conjunctivitis. Since some observers have reported rickettsialike bodies in trachoma, the authors tested the blood of 45 patients suffering from trachoma, by the Weil-Felix test, and found the results to be negative.

Eugene M. Blake.

✓ Bietti, G. B., and Scalfi, L. Effects of penicillin in the conjunctival sac at various intervals after its instillation. Studi Sassarese, 1945, v. 23, no. 1, pp. 1-6.

The author found that a solution containing 2,000 Oxford units per cubic centimeter instilled into the conjunctival sac every two to four hours was effective against all of the common pathogenic microorganisms of the conjunctiva. When the secretion is especially abundant and when more resistant organisms, such as Koch-Weeks and Pfeiffer bacilli, are present, more frequent use of stronger concentrations is required. Local application of penicillin in conjunctival disease is at least as effective as its intramuscular use.

Eugene M. Blake.

Davids, H. Rössler's remarks on an article: "A contribution to therapy of trachoma." Klin. M. f. Augenh., 1943, v. 109, Jan.-Feb., p. 107.

Davids defends himself against Rössler's accusation that he published his recommendation of treating trachoma with cold applications as a "new method of therapy" and also that he omitted to mention the treatment with albucid in the same article. The first publication concerning trachoma thera-

py with sulfa drugs came to Davids's knowledge after conclusion of his experiments with cold (ice, not carbon-dioxide snow) applications.

F. Nelson.

Khanolkar, V. R. **Bowen's disease of the conjunctiva.** Amer. Jour. Ophth., 1946, v. 29, May, pp. 515-519. (6 figures, references.)

Knapp, A. A. **The eye as a guide to latent nutritional deficiency diseases; a clinical study of ocular diseases at an advanced base hospital in the Southwest Pacific.** Bull. New York Acad. Med., 1946, v. 22, April, p. 217. (See section 17, Systemic diseases and parasites.)

Miller, C. D., and McIntyre, D. W. **A syndrome termed Reiter's disease (urethritis, conjunctivitis, and arthritis).** Ann. Int. Med., 1945, v. 23, Oct., p. 673.

"Reiter's disease" was not recognized as a clinical entity until 1916, when Reiter described a syndrome of urethritis, conjunctivitis, and arthritis which was nongonorrheal in nature.

This syndrome is a definite clinical entity of unknown cause, presumed to be infectious because of its clinical course. The possibility of its being a venereal disease is remote. The possibility that a virus is the etiologic factor is being investigated.

Complications are infrequent but may be very severe. The prognosis is usually good, but recurrences are noted in about one fourth of the patients. None have died.

Eye complications are infrequent. Episcleritis, iritis, and keratitis have been observed. The keratitis heals with scarring. Herpes of the conjunctiva and

cornea have also been recorded.

It must be assumed that the incidence is more frequent than appears from the literature. Since the syndrome is little known, many cases are not properly diagnosed nor recognized.

Theodore M. Shapira.

Miterstein, B., and Stern, H. J. **Treatment of acute conjunctivitis and trachoma with sulfonamides.** The Lancet, 1945, May 26, p. 649.

The acute phase of Koch-Weeks conjunctivitis is described. If left untreated, it subsides in 6 to 8 weeks, but usually becomes chronic. In 13 patients, one eye was treated with silver nitrate, the other with a 5-percent ointment of Pyranil (a compound containing p-amino-phenyl-sulphonamide in addition to pyridine-dicarboxic acid anhydride). The results in 12 cases were equally good in both eyes. Treatment with both silver nitrate and Pyranil was more successful than treatment with either alone.

Sulfanilamide by mouth, 0.05 gm. per Kg. body-weight daily, was tried without effect. However, sulfapyridine by mouth, 0.05 gm. per Kg of body weight, produced dramatic improvement within 24 hours. In a few hours the bacilli showed pleomorphic changes, and became fewer in number. After 14 hours, smears were consistently negative. Cases were clinically cured in three to seven days. Local treatment was sometimes needed. Treatment was continued at least a week beyond the time of clinical cure to avoid relapse. Sulfapyridine applied locally had no effect.

Sulfanilamide, sulfapyridine, and pyranil have proved valuable in treating trachoma. The authors think Pyranil is the treatment of choice in cases associated with severe corneal complications.

Robert N. Shaffer.

Seefelder, R. **Conjunctival scar formation in vernal catarrh.** *Klin. M. f. Augenh.*, 1943, v. 109, Jan.-Feb., p. 32.

It is generally accepted that vernal conjunctivitis heals without scar formation, although sometimes after many years scarring may develop. Saemisch, who was the first to describe the disease, noted in 1904 that the inflammatory process may eventually result in scar formation and atrophy. Seefelder reports the case of a man, 30 years of age, who had been under his observation for 16 years because of typical vernal conjunctivitis with eosinophilia in the blood and in the conjunctival secretion, and scar formation in the cornea. There was no trace of pannus and certainly no complicating trachoma. The tarsal conjunctiva became scarred throughout. The uniform reticular scarring, partly netlike, closely resembled trachoma. Biopsy specimen of tissue of hypertrophic conjunctival islands showed typical histologic features of conjunctivitis vernalis.

F. Nelson.

White, J. P. **Haemorrhage from the conjunctiva. Notes on a case of capillary angioma.** *Brit. Jour. Ophth.*, 1945, v. 29, Dec., pp. 635-637.

A case of capillary angioma on the palpebral conjunctiva of the right upper lid is reported. On two occasions the patient had suffered from bloody tears. A histologic examination of the tissue showed that the epithelium was reduced to a single row of cells where the capillaries reached it. It would appear therefore, that the angioma was the source of the hemorrhages reported by the patient. Edna M. Reynolds.

6

CORNEA AND SCLERA

Albanese, A. A. **Corneal vascularization in rats on a tryptophane-deficient**

diet. *Science*, 1945, v. 101, June 15, p. 619.

It has been repeatedly reported that riboflavin deficiency produces corneal vascularization in rats. The author had noted corneal vascularization in rats placed on a tryptophane-deficient diet. He then fed a control group of nine rats a tryptophane-deficient diet. Another group of nine rats was given a similar diet to which an adequate amount of riboflavin had been added. Corneal vascularization and cataracts developed at exactly the same rate in the two groups. After five weeks both groups were fed the basic tryptophane-deficient diet without riboflavin but with added tryptophane. All rats rapidly gained in weight, the corneas recovered completely and the cataracts partly disappeared.

Recent reports of corneal vascularization in man which failed to respond to riboflavin therapy suggest the possibility of an exogenous or endogenous deficiency of tryptophane and the employment of tryptophane as a therapeutic measure. Robert N. Shaffer.

Babel, Jean. **The fate of corneal transplants.** *Ophthalmologica*, 1945, v. 109, Jan., pp. 1-18.

In spite of extensive research the changes in corneal transplants still are not satisfactorily explained. The author considers only autogenous grafts as *heterogenous grafts never last long*. They are eliminated and replaced by tissue that originates in the host.

The pertinent literature is reviewed in great detail, and reports of the author's own experience are added in detail, including clinical and histologic descriptions of such cases. Among sixty corneal transplants; two corneas were examined histologically. The preparations all came from eyes in which a

second transplant was necessary, chiefly because of increasing cloudiness of the first. The author believes that the results in his eyes, despite their lack of transparency, provide some material toward a better understanding of the mechanism and the outcome in corneal grafting. The transplanted corneas which were examined histologically had been in place for periods that varied between four days and five years.

The main corneal structures, the stroma, and Bowman's and Descemet's membranes remained intact within the graft. The epithelium might be unchanged or disorganized but was different from the epithelium of the host. A necrosis of the fixed and wandering cells took place; these were replaced by other cells of unknown origin. In case of inflammation or infection, vessels from the adjoining cornea or iris invaded the transplant, bringing connective tissue and nerves into the graft, and changing its structure. Its border always remained distinct. The clinical and experimental work led to the same conclusion that the original transplant survives. It does not explain the biologic and physico-chemical conditions which sometimes keep the transplant clear and sometimes not. It is essential that the borders of the wound in the host and the margins of the graft are sharply and smoothly cut and neatly adapted to each other so as to prevent the epithelium from proliferating and growing into the wound. A careful section of Descemet's membrane is also important because remains of this membrane might give rise to obstructing layers of retrocorneal tissue. (15 tables, references.)

Alice R. Deutsch.

Berens, C. Corneal punch for square and rectangular transplantations of

cornea. *Arch. of Ophth.*, 1946, v. 35, Jan., p. 47.

When a rectangular implant is used in performing transplantations of the cornea, a protruding lip of cornea may remain posteriorly. This is especially likely to happen when the recipient cornea is thickened or edematous. The removal of this lip with instruments ordinarily available has been found most difficult. Berens describes a square corneal punch which he has devised to facilitate the procedure.

R. W. Danielson.

Blum, J. D. The heredo-familial corneal degenerations and their relation to congenital corneal opacity. (Clinical and genealogical study.) *Ophthalmologica*, 1945, v. 109, March, pp. 123-136.

The author recognizes the importance of Bueckler's paper, which brought order into the very confused nomenclature of the heredo-familial corneal dystrophies. He describes the three types of heredo-familial corneal degenerations which differ in their clinical appearance and pattern of inheritance and discusses their differentiation from other corneal abnormalities. He also reports the pedigree and clinical observations on patients with similar lesions under his care. In the discussion of differential diagnosis, lentic interstitial keratitis, epidemic keratoconjunctivitis, and corneal degeneration of Hurler's dysostosis are mentioned, and certain congenital corneal opacities are described in detail. Corneal opacities with ocular malformations, embryotoxon, and sclerophthalmia are not considered in this paper. He pays especial attention to a type of congenital corneal opacity which in its clinical picture closely resembles group 3 of Bueckler. Both lesions are familial and

recessive, they are bilateral, interstitial, denser in the center than in the periphery, with an intact epithelium and without any signs of inflammation or vascularization, and they cause considerable disturbance of vision. They differ from each other only in that the congenital opacities are present at birth and corneal dystrophies start during the first 10 years of life and progress steadily. The author reports the history, clinical appearance, and pedigree in two cases of congenital corneal opacity, and in five cases of corneal dystrophy group three. (2 pedigrees, references.)
Alice R. Deutsch.

Claus, S. Nevogenous pterygium. *Klin. M. f. Augenh.*, 1943, v. 109, Jan.-Feb., p. 59.

A man, 41 years of age had noticed a gradually increasing gray spot in his left eye. At the limbus at the 10-o'clock position, a flat, freely movable, pigmented nevus of the conjunctiva was found associated with a pterygium which extended slightly beyond the limbus. Because of possible malignancy, the whole structure was removed and examined histologically. It proved to be a genuine nonmalignant pigmented nevus and a typical pterygium. No cellular infiltration was found in the surrounding tissue. Apparently the pterygium originated directly from the adjacent nevus, the first case of its kind to be published. (References.)

F. Nelson.

Castroviejo, R. Corneal transplantation. *Amer. Jour. Nursing*, 1946, v. 46, Jan., p. 35.

Most favorable for keratoplasty are corneas with: central opacities in which the transplant will remain surrounded by healthy tissue; keratoconus when vision cannot be improved by regular

or contact lenses or when the latter are not tolerated; and not too extensive interstitial keratitis. Less favorable are some corneal dystrophies, diffuse superficial opacities, adherent leucomas, and descemetocoeles.

Various types of operation are described. It is the opinion of the author that this operation offers no greater risk than do operations for cataract, glaucoma, and detachment of the retina. The results compare favorably with those of operations routinely practiced by ophthalmic surgeons.

Francis M. Crage.

Dame, L. R. Accessory lacrimal gland on the cornea. *Amer. Jour. Ophth.*, 1946, v. 29, May, pp. 579-582. (6 figures, references.)

Donahue, H. C. Complications of herpes zoster ophthalmicus. *Amer. Jour. Ophth.*, 1946, v. 29, May, pp. 582-585. (See Section 14, Eyelids and lacrimal apparatus.)

Evans, C. A., and Bolin, V. S. Corneal reactions to viruses of equine encephalomyelitis after intraocular injection, *Proc. Soc. Exper. Biol. and Med.*, 1946, v. 61, Feb., p. 106.

It has been shown that injections of certain viruses produce specific reactions in ocular tissues. In these studies the viruses of western and eastern equine encephalomyelitis were injected into the anterior chambers of the eyes of rabbits. Corneal edema and opacification were produced, analogous to the toxic reaction demonstrated for the influenza virus. In general, the viruses could not be found in the aqueous after 48 hours, demonstrating that the corneal opacity is not the result of growth of the virus in the eye, even though such growth may take place to a limited

extent. As in the case of the influenza virus, large doses were required to produce the corneal reaction (the most characteristic ocular change noted). It is felt that the corneal changes are attributable to the toxic properties of the viruses used. Benjamin Milder.

Friede, R. The origin of pterygium and keratoplasty for its recurrence. *Klin. M. f. Augenh.*, 1943, v. 109, Jan.-Feb., p. 41.

Many features in the clinical picture of pterygium are still uncertain. Whether the disease is a manifestation of a lesion of the cornea or the conjunctiva is still in dispute. Friede believes that it probably originates in the episclera, possibly under the influence of an unknown pathogenic germ. Hereditary factors, mechanical influences such as pressure of the lids, and various chemical and physical irritants may play a part in the development of pterygium. It is Friede's conviction that the operative procedures should be applied as early as possible and that simple excision is contraindicated since it may be followed by shrinkage, recurrence, and impeded ocular movements toward the temporal side. He advocates the recession of the entire structure with temporary suturing of the head to the caruncle, and closing of the conjunctival wound directly at the limbus. He believes that this is the simplest and most satisfactory operation. Transplantation of free or pedunculated flaps of conjunctiva as well as Thiersch grafts of skin and labial mucous membrane have been advocated repeatedly in order to avoid or cure recurrences. The aim of all these methods is the formation of a wall at the limbus to prevent new episcleral and conjunctival tissue from crossing the corneoscleral region. This is particularly indi-

cated when the neck of the pterygium is wide. Corneal flaps taken either from the patient's own eyes or from enucleated or cadaver eyes gave most satisfactory results in cases of recurrences. These flaps, if properly secured, heal well and quickly, before the vascularized conjunctival and episcleral tissue has time to cross. The flaps stay clear for about two weeks; later they become opaque and are completely absorbed eventually. It is important to remove as much as possible of the episcleral tissues from the posterior surface of the pterygium while performing the recession. F. Nelson.

Reis, J. L. A corneal graft operation for recurrent pterygium. *Brit. Jour. Ophth.*, 1945, v. 29, Dec., pp. 637-640.

The common methods of pterygium operations aim at the separation and displacement of the pterygium from the cornea. This leaves an open scar of the cornea which becomes covered with conjunctiva and forms a pseudopterygium which has a tendency to grow. To prevent this complication, a modified McReynolds pterygium operation is described in which the denuded corneal area is covered by a corneal graft under a conjunctival flap.

The procedure is described in detail as it was performed on an eye with recurrent pterygium. (1 drawing.)

Edna M. Reynolds.

Smelser, G. K. The influence of vehicles and form of penicillin and sulfonamides on mitosis and healing of corneal burns. *Amer. Jour. Ophth.*, 1946, v. 29, May, pp. 541-551. (5 figures, references.)

Schaeffer, A. J. Effect of certain amino acids on healing of experimental

wounds of the cornea. *Proc. Soc. Exper. Biol. and Med.*, 1946, v. 61, Feb., p. 165.

An attempt has been made to influence regeneration of experimental wounds of the cornea, in vivo, by the administration of amino acids. In the first of a series of experiments, corneas were abraded over a measured area in both eyes of each animal. A solution which included cystine, proline, asparagin, and glutamine in saline solution was instilled in the right eye. In another series an ointment was used. In the treated eyes, healing was complete in 12 to 42 hours, whereas in the control eyes, healing took place in 55 to 120 hours. In the third group, deep corneal lesions were similarly treated, and healed in 32 to 56 hours, as compared with four to five days in the control group.

The author has used amino-acid preparations in man in the treatment of 100 corneal lesions.

Benjamin Milder.

Wright, H. B. Corneal transplantation and nursing care. *Amer. Jour. Nursing*, 1946, v. 46, Jan., p. 36.

The author, a registered nurse, describes preoperative and postoperative care in detail. Particular emphasis is placed on the mental state of the patient. Acquainting the patient with his surroundings helps to prevent the lost feeling he might have on his return from the operating room. A special stretcher is used to transfer the patient to his bed. Details of a diet intended to prevent the use of the facial muscles in chewing are given. The author advises against the use of tooth brushes, suggesting instead the use of liquid mouth washes through a tube and applicators to cleanse the teeth.

Francis M. Crage.

UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Bietti, G. B. Bilateral fissurelike pupils associated with Bitot's spots. *Studi Sassares*, 1943, v. 21, pp. 1-11.

An infant girl, aged 1½ years, presented congenital, bilateral fissured pupils, placed obliquely. There was slight light reaction and the child followed a light readily. No other congenital defects were observed, but there were xerotic triangular areas on the temporal side of the bulbar conjunctiva that resembled Bitot's spots, although there was no evidence of avitaminosis.

The condition may be unilateral or bilateral and the fissures may be parallel, oblique, vertical, or horizontal. Other congenital defects are often found in association with the pupillary defect, and heredity is occasionally a factor. A good discussion and bibliography complete the article. (1 figure.)

Eugene M. Blake.

Blum, J. D. Indications and results from Franceschetti's corepraxy. *Ophthalmologica*, 1943, v. 106, July, pp. 1-12, and *Ophthalmologica*, 1943, v. 106, Aug., pp. 66-79.

The author considers Franceschetti's corepraxy a new and very effective method of producing an artificial pupil, especially in surgical cases of aphakia with displaced and partially occluded pupil, after postoperative complications.

He reviews the history of the surgery of the artificial pupil; mentions iridocapsulotomy and iridocapsulectomies as well as other more complicated procedures like Blaskovics's cicatricectomy; describes the surgical technique of these operations and discusses their

improvement, dangers, disadvantages.

Corepraxy is considered to be a less harmful operation in properly selected cases. It is most favorable in aphakic eyes in which the pupil is greatly displaced upward and is occluded by a membrane that is not adherent to the iris. Eyes with iris prolapse, thick, calcified, pupillary membrane, vitreous changes, or considerable corneal disease are less promising.

The surgery is performed as follows: Through a small keratome incision opposite the last remains of the pupil, a pointed hook is introduced. The hook is manipulated so as to catch the pupillary margin and bring the iris out through the incision, where it is cut by a deWecker scissors. An atrophic iris might not give way but tear instead. In this case several similar tears are made to form some kind of pupil. The resulting pupil is usually oval, in contradistinction to the slit-shaped pupil that is the result of other surgical methods. In traumatic pupillary displacements in young persons, an operation sometimes results in a thin slit, instead of the desired oval artificial pupil. It is a mistake to try to enlarge the pupil at once; more advisable to wait and to perform another corepraxy later, perpendicular to the first.

A description of 20 cases of corepraxy follows. Sixteen eyes were aphakic, two had glaucoma, and two had displaced pupils after injuries. In spite of the generally poor prognosis in this type of operation the author did not lose any eye, even when he operated on eyes which were hypotonic before the surgery. An improvement of vision resulted in 17 out of the 20 eyes; in the other three retinal detachment, hemorrhagic glaucoma, and hypotony developed. (References.)

Alice R. Deutsch.

Donahue, H. C. Complications of herpes zoster ophthalmicus. *Amer. Jour. Ophth.*, 1946, v. 29, May, pp. 582-585. (See Section 14, Eyelids and lacrimal apparatus.)

Harley, R. D., and Wedding, E. S. Syndrome of uveitis, meningo-encephalitis, alopecia, poliosis, and dysacusia. *Amer. Jour. Ophth.*, 1946, v. 29, May, pp. 524-535. (17 figures, references.)

Icaza y Dublan, J. M. Cholesterin in the anterior chamber. *Bol. del Hosp. Oft. de Nuestra Señora de la Luz*, 1946, v. 3, Jan.-April, pp. 143-146.

The patient was a married woman of 20 years. Three years previously, some of her family had noticed that the right eye looked like a cat's eye, having a yellowish reflex. The eye was without pain. Upon examination the right iris was found to have undergone degeneration, and there was complete posterior synechia with a pupillary membrane. The intraocular pressure was above normal and there was no light perception.

The striking feature of the case was that the lower half of the anterior chamber was occupied by innumerable iridescent particles. Some of the floating crystals were needlelike, others formed plaques, some did not glisten. It is suggested that the initial stage of the formation of the cholesterin crystals had been a metastatic abscess in the vitreous, and that the general ocular disturbance had been induced by uterine infection. Several years previously, the patient had had two abortions within four months. She had since given birth to a healthy child.

W. H. Crisp.

Johnson, K. B. Metastatic carcinoma of the choroid. *Canadian Med. Assoc. Jour.*, 1946, v. 54, Jan., p. 46.

The author describes four cases of metastatic carcinoma of the choroid. In each patient the carcinoma was primary in the breast, which is the commonest site of the primary growth. In three patients metastases in other organs had not been found before those that had invaded the eye. In two, the ocular lesion had occurred seven years after the primary growth. In three, chest metastasis was eventually found. Ophthalmoscopically, a detachment of the retina extended up to the disc in all cases.

The patients live from four weeks to two years after discovery of the metastatic tumor and usually die in the fourth and fifth decade of life. The metastasis in the eye results from blood-borne emboli of tumor cells.

A flat thickening of the choroid is present, higher at the posterior pole. The vitreous remains clear, and a large detachment of the retina may occur at any time. Growth is rapid but glaucoma is late. Early pain is diagnostic.

Francis M. Crage.

Laval, Joseph. Bilateral uveitis with retinal detachment, poliosis, alopecia, and dysacusia. *Amer. Jour. Ophth.*, 1946, v. 29, May, pp. 536-540. (2 figures.)

8

GLAUCOMA AND OCULAR TENSION

Gradle, H. S. Preglaucoma. *Amer. Jour. Ophth.*, 1946; v. 29, May, pp. 520-523.

Paulo Filho, A., Sébas, S. R., and Giardulli, A. Siderosis bulbi. *O Hospital*, 1945, Sept., pp. 339-343 (reprint.)

Microscopic section of an enucleated eyeball in which this complication had arisen leads to the following conclusions:

The presence of an iron fragment in the anatomic elements of the anterior pole of the eyeball does not always produce siderosis bulbi. The siderosis once begun continues even after the foreign body is removed. Rarely the siderosis involves all the anatomic elements of the eyeball. It causes necrosis of the essential cells of the retina. (3 figures, references.)

W. H. Crisp.

Paulo Filho, A., and Sebas, S. R. Artificial thickening of the conjunctival flap in fistulizing operations. *Brasil-Medico*, 1945, v. 59, April 7 and 14, 9 pp. (reprint.)

The authors' technique is recommended as especially protecting against the risk of iridocyclitis. They begin the conjunctival incision near the superior fornix, cutting down to the sclera. Care is taken to carry down with the flap as much as possible of the connective tissue. Then the bulk of the subconjunctival connective tissue is separated from the conjunctiva itself, by means of scissors, and over as large an area as possible, so that this layer of tissue is accumulated at the base of the flap. After completing the other steps of the operation (whatever form of fistulizing operation is employed), and following suture of the lips of the conjunctiva, a spatula inserted at the temporal extremity of the sutured incision is used to depress the soft connective tissue down to the region of the anticipated filtration bleb. (3 figures.)

W. H. Crisp.

Roethth, A. de. Cyclodiathermy in treatment of glaucoma due to rubeosis iridis diabetica. *Arch. of Ophth.*, 1946, v. 35, Jan., pp. 20-22.

Rubeosis of the iris in diabetes is one of the most disastrous ocular diseases, for it usually involves both eyes and,

with rare exceptions, causes uncontrollable glaucoma. In none of the 32 cases of this disease found in the literature could miotics control the tension. The usual surgical procedures were useless, or even disastrous. The intolerable pain caused by the glaucoma necessitated enucleation in several cases. Fralick, in his excellent and comprehensive paper on this subject, reported the removal of four eyes in three cases of diabetic rubeosis of the iris. Any attempt to save some of the vision, or even the eyeball alone, is worth while.

After disappointing results with various types of operations, the author found that cyclodiathermy is the only procedure that reduces the tension in cases of glaucoma due to rubeosis. However, the treatment easily results in atrophy of the eyeball if used too extensively, particularly if both long posterior ciliary arteries are destroyed. These vessels are not damaged if the applications are made in front of the insertion of the rectus muscles as suggested by Vogt. But even if the cyclodiathermy is not done over a sufficiently large area to normalize the tension, it does alleviate the pain. Unfortunately, the progress of the damage to the retinal vessels cannot be checked.

R. W. Danielson.

Torres Estrada, Antonio. **Medical and surgical control of glaucoma.** Bol. del Hosp. Oft. de Nuestra Señora de la Luz, 1945, v. 3, Sept.-Dec., pp. 89-109.

This is a somewhat detailed consideration of the treatment of glaucoma. The author regards chronic simple glaucoma as a malady arising from a general systemic cause. He recognizes two distinct periods in development of the disease, functional and degenerative. The functional period is suscep-

tible of being treated with success in the medical field. The degenerative period calls for surgery, which should be undertaken as soon as medical care is unable to maintain adequate reduction of tension. Hemicyclodialysis is the author's surgical treatment of choice, tending to reestablish physiologic drainage of the aqueous humor. In advanced cases this operation should be combined with iridectomy. (9 figures.)

W. H. Crisp.

Torres Estrada, Antonio. **Hemicyclodialysis is an operation which reestablishes physiologic drainage of the intraocular fluids.** Bol. del Hosp. Oft. de Nuestra Señora de la Luz, 1946, v. 3, Jan.-April, pp. 121-129.

This paper, presented to the Second Pan-American Congress of Ophthalmology, Montevideo, discusses the general principles of glaucoma surgery, and urges the advantage of doing a very extensive cyclodialysis, to which the author has given the title "hemicyclodialysis," and which he considers superior to any of the filtration operations. He believes that the action of hemicyclodialysis is by opening the canal of Schlemm and the meshes of the pectinate ligament. The operation is particularly effective in the early stages of chronic simple glaucoma. The failure of any glaucoma operation is probably attributable to advanced sclerotic and degenerative changes in the pectinate ligament. (2 illustrations.)

W. H. Crisp.

9

CRYSTALLINE LENS

Geller, K. **Late traumatic rosette after contusion with Vossius's ring opacity.** Klin. M. f. Augenh., 1943, v. 109, Jan.-Feb., p. 105.

A Vossius ring combined with rosette-shaped opacities at the anterior and posterior surface of the senile nucleus was seen in the eye of a locksmith. He had had a contusion about 30 years before and his vision had become considerably impaired shortly after the injury. F. Nelson.

Goar, E. L., and Potts, C. R. The relationship of rubella in the mother to congenital cataracts in the child. *Amer. Jour. Ophth.*, 1946, v. 29, May, pp. 566-569. (References.) Also in *Trans. Amer. Ophth. Soc.*, 1945.

Prendergast, J. J. Congenital cataract and other anomalies following rubella in mother during pregnancy. *Arch. of Ophth.*, 1946, v. 35, pp. 39-41.

The reported cases of congenital defects in children born of mothers who had rubella during the first three months of pregnancy are briefly reviewed. The pathologic observations in the cases of congenital cataract and the possible significance of the time of development of these anomalies in the embryo are discussed. The results of a survey made among some of the ophthalmologists, pediatricians, and obstetricians in California to estimate the incidence of these defects in the state are reported. R. W. Danielson.

Rosen, Emanuel. Diabetic needles. *Brit. Jour. Ophth.*, 1945, v. 29, Dec., pp. 645-653.

The author reports a characteristic lenticular opacity associated with diabetic cataract which he considers a presumptive if not a positive diagnostic sign in diabetes. The sign is not constant but when present is specific for diabetes. The sign consists of lenticular opacities in the periphery of the lens which are linear streaks no thicker

peripherally than centrally.

A series of 19 cases of diabetes is presented, all of which showed the diabetic-needle sign. Drawings of the opacities of the lens in each case are included. Many showed nuclear and cortical lens opacities as well as the diabetic needles. Edna M. Reynolds.

Rosen, Emanuel. Coppock cataract and cataracta pulverulenta centralis. *Brit. Jour. Ophth.*, 1945, v. 29, Dec., pp. 641-644.

A report of four cases of central pulverulent cataract is given with a series of slitlamp photographs. The lesion is believed to have a strong familial tendency but the author reports having seen 24 in 18 months. There were several colored patients in this group.

The opacity occupies the most central portion of the lens and its center is somewhat transparent. It is composed of small, white dots which are highly refractile, located in the fetal nucleus.

In three of the patients, some endocrine dysfunction was noted. One patient, a man, 26 years of age, had soft, silky hair in the female pattern of distribution, adiposogenital dystrophy, and a high-pitched voice. A second patient had congenitally small kidneys and the third had an acrocyanosis.

The author recommends that the term "Coppock cataract" be dropped for this type of opacity and that an anatomically selected term be substituted. (4 figures, references.)

Edna M. Reynolds.

Szinegh, B. Anterior capsular cataract complicated by bilateral zonular cataract in a twin. *Klin. M. f. Augenh.*, 1943, v. 109, Jan.-Feb., p. 83.

Of two identical twin brothers, seven years of age, one was normal although

slightly rachitic and retarded in development; the other had anterior polar and zonular cataracts in both eyes. He also had rickets and had suffered from frequent convulsions, possibly a manifestation of tetany, although the blood calcium was of normal value and the existence of a latent tetany could not be proved. It is most likely that the cataracts were caused by a pathologic process in early fetal life, although it is not known what kind of lesion was responsible. Cataracts that are a manifestation of a defect of the germ plasma appear in both twins. (References.)

F. Nelson.

Thannhauser, S. J. Werner's syndrome (progeria of the adult) and Rothmund's syndrome; two types of closely related heredofamilial atrophic dermatoses with juvenile cataracts and endocrine features. *Ann. Int. Med.*, 1945, v. 23, Oct., p. 559.

The symptoms of Werner's syndrome are demonstrated in case reports in the literature and in four of the author's own. With the exception of Oppenheimer and Kugel's cases, the cases of Werner's syndrome in the literature are published under the misleading designation "Scleroderma and cataracts."

The skin changes in Werner's syndrome are not those of true scleroderma. Because of its heredofamilial occurrence it is suggested that the skin changes, as the other symptoms of Werner's syndrome, are the result of a defective germplasm which does not appear until the second and third decades of life. "Progeria of the adult" is suggested as a better name since all symptoms of Werner's syndrome result in presenility of the patient.

For the skin changes a purely descriptive name, such as "heredofamilial

atrophic dermatosis with skin ulcers" seems more appropriate.

The skin ulcers in Werner's syndrome are not entirely trophic in origin. They appear only on exposed parts and are probably the result of pressure upon the thin, atrophic, and stretched skin. The healing of the ulcers by grafting skin upon the defects supports such an opinion.

The symptoms of Rothmund's syndrome are illustrated by case reports in the literature and by a case of the author's own.

The skin changes of Rothmund's syndrome are classified as "poikiloderma" or "scleropoikiloderma." Such a classification is not justified by the heredofamilial occurrence of the skin disorder nor by the histologic findings. It seems appropriate to use a simple descriptive name such as "heredofamilial atrophic dermatosis with telangiectases."

Both syndromes may occur in incomplete forms.

The heredity in both forms is recessive. The collateral occurrence in brothers and sisters of one generation is often observed. Rothmund's syndrome usually starts in childhood; Werner's syndrome in the second and third decade.

Clinical syndromes related to Werner's and Rothmund's syndromes are discussed. A chart tabulating the characteristics of Werner's and Rothmund's syndromes in comparison with related clinical entities is presented to aid in the differential diagnosis.

Cataracts are of the same kind in both syndromes. They develop as star-like opacities in the periphery of the lens, mostly at the posterior pole. However, the age at which the cataracts begin to develop is significant. In Rothmund's syndrome they are present at

the age of three to five years; in Werner's syndrome they develop in adult life, between the ages of 20 and 30 years.

That these syndromes are the result of a purely ectodermal dysplasia or a primary disturbance of endocrine function is denied. Their recessive heredity suggest that multiple defects of the germ-plasm become manifest in abiotrophic degeneration of various organs at different periods of life.

Theodore M. Shapira.

10

RETINA AND VITREOUS

Buxton, R. J. **Retinal haemorrhages in aplastic anaemia.** *Brit. Jour. Ophth.*, 1945, v. 29, Dec., pp. 632-635.

The retinal lesions found in a severe and fatal case of aplastic anemia are described and illustrated.

The patient, a male, was 28 years of age. He was admitted to a hospital after two days of illness with generalized aching, fever, and bleeding gums. He had had syphilis, and had completed two full courses of treatment with arsenic and bismuth. He had received the first injection of the third course three days before hospital admission.

The patient's blood picture showed hemoglobin 16 percent, red blood cells 750,000, white blood cells, 3,100, polymorphonuclear leucocytes 19 percent, lymphocytes 78 percent, mononuclear cells 3 percent, and very few platelets. Bleeding time was greatly prolonged. Clotting time was normal. A blood-film study showed no evidence of blood regeneration.

The ophthalmic examination showed marked pallor of the conjunctiva and in the fundus of each eye there was blur-

ring of the upper nasal edge of the optic disc. The retinal vessels were normal in size and contour. There were gross hemorrhages of three types; namely, moderate-sized, flame-shaped plaques up to 2 D.D. long, some with a yellowish center, and glistening slightly; narrow streaks, about 1 D.D. long, close to blood vessels; and two or three punctate hemorrhages in the macular areas. One small spot of exudate was noted. There was general retinal pallor and a slight degree of retinal edema surrounding the optic disc.

The patient was given a number of blood transfusions, 300 gm. of ascorbic acid daily, 2 c.c. of neohepatex intramuscularly daily, and iron and ammonium citrate.

The patient died. The post-mortem examination showed the classical picture of complete bone marrow aplasia and multiple submucous hemorrhages. (1 figure.) Edna M. Reynolds.

Easton, D. M. **Acetylcholine in the light and dark adapted frog retina.** *Proc. Soc. Exper. Biol. and Med.*, 1945, v. 59, p. 31. (See Section 3, Physiologic optics, refraction, and color vision.)

Fink, A. I. **Clinical study of effect of tobacco on the normal angioscotoma.** *Arch. of Ophth.*, 1946, v. 35, Jan., pp. 15-19.

In 1926, the classic form of the angioscotoma was first described by Evans. This work has been a source of aid to clinicians investigating disease of the nasal accessory sinuses, forms of edema, glaucoma, and menstrual disturbances. The research worker, too, has had recourse to angioscotometry in studying the effects of sulfanilamide, inhalation of oxygen, and amphetamine

sulfate, and in making studies of the effects of high altitude on the visual fields during World War II. The method has not been used, however, to determine the effect of smoking on the normal angioscotoma. Since tobacco smoking is so widespread, it was thought that knowledge of its effect might be of clinical and experimental value. It was therefore decided to study the effect of smoking one cigaret with inhalation.

The smoking of a certain popular brand of cigaret containing two percent nicotine produced a widening of the angioscotoma, cigaretts containing one tenth as much nicotine produced an alteration of the angioscotoma of lesser degree, and the controlled inhalation of an unlighted cigaret produced no alteration of the angioscotoma.

It seems probable that the effect on the angioscotoma was brought about by the nicotine. R. W. Danielson.

Hoffman, P. M. **Retinal venous thrombosis following reaction to vaccine.** *Arch. of Ophth.*, 1946, v. 35, Jan., pp. 45-46.

The uncommon occurrence of retinal periphlebitis and progressive thrombosis in a young adult following stimulating doses of vaccines with associated anaphylactoid reaction is recorded.

In the early stage the inferior temporal veins were involved, and progressive thrombotic changes in the fundus and visual fields were followed. It is of interest that the superior nasal veins, although they had presented similar early periphlebitic constrictions and exudate, did not become thrombosed, and the exudate disappeared completely. Optic neuritis occurred in the affected eye during the third week of the disease, followed one week later by a macular lesion. Ocular tension

was not notably affected during six weeks' observation of the patient.

R. W. Danielson.

Márquez, Manuel. **Technique and clinical value of hypertonic injections into Tenon's capsule for detachment of the retina.** *Monterrey Medico*, 1945, March 31, pp. 2397-2403.

Márquez says the technique here given does not appear in any book. He describes a case of retinal detachment of traumatic origin. There was a small tear at the level of the macula, through which could be seen the red color of the choroid. The tear was so small that it could not be seen in the indirect image. The detached area involved more than one half the retina, and invaded the macula. Central vision was absent.

After a preliminary anesthetic injection of 2-percent novocaine, a 15-percent solution of sodium chloride, with a small amount of novocaine was injected with a curved needle, beveled toward its concavity and the concavity directed toward the eyeball. The injection was made downward and somewhat outward, as far backward as possible in Tenon's space. Two days later the retina was found reattached, with the visual field almost entirely restored including that of the macular region, but with a slight defect below. The macular tear was closed, although the injection had not been made at its level. A similar injection was made six days later, the field continuing to gain. All that now remained of the tear was a small dark scar. The final visual acuity of this eye was 0.7: the original visual acuity was unknown. In a second case the result was unsatisfactory. (1 field.)

W. H. Crisp.

Rados, A. **Occurrence of glioma of retina and brain in collateral lines in**

same family. *Arch. of Ophth.*, 1946, v. 35, Jan., pp. 1-12.

In this monographic study the hereditary basis of malignant growths, especially that of retinoblastoma, is evaluated with reference to horizontal, vertical, and collateral inheritance in the family history. The importance of research on twins is stressed.

A case of glioma of the retina and one of glioma of the brain, occurring in collateral lines, and hitherto undescribed, are reported. R. W. Danielson.

Rosen, E. **Congenital retinal fold.** *Arch. of Ophth.*, 1946, v. 35, Jan., pp. 28-32.

The author reviews the literature and reports two cases. The mother of one patient had measles during the fifth month of pregnancy. Congenital retinal folds have been confused with glioma.

R. W. Danielson.

Welt, Milton. **A clinical study of the relation of the size of Mariotte's blind spot and the angioscotomas to retinal arterial hypertension.** *Ophthalmologica*, 1945, v. 109, Feb.-March, pp. 137-158. (See Section 1, General methods and diagnosis.)

11

OPTIC NERVE AND TOXIC AMBLYOPIAS

Bruetsch, W. L. **Malaria therapy in syphilitic optic atrophy.** *Jour. Amer. Med. Assoc.*, 1946, v. 130, Jan. 5, p. 14.

The author advocates the abandonment of intraspinal therapy in neurosyphilis because a sudden loss of vision occurs in the course of this treatment in 10 percent of the patients.

The term "tabetic optic atrophy" should be discarded and replaced by "primary syphilitic optic atrophy," be-

cause this atrophy not infrequently occurs in dementia paralytica, in meningo-vascular syphilis, and even in syphilitic persons without tabes.

The local pathologic changes are identical in the three main types of neurosyphilis. The atrophy is a chronic inflammatory process followed by nerve-fiber degeneration that starts in the intracranial portion of the nerve and spreads in both directions.

Activation of the mesodermal tissue and not the hyperpyrexia seems responsible for the arrest of the disease. Fever alone is not deleterious to the *Treponema pallidum*.

When one course of malaria does not prevent further visual loss, another course is indicated. The second course requires the use of quartan malaria since immunity to the tertian type will have taken place in the interval. Since penicillin reduces the anti-inflammatory action of malaria therapy in neurosyphilis it might be advisable to administer penicillin with the malaria treatment, or after it; to use penicillin alone would be hazardous.

In the author's post-mortem studies, the arachnoidal adhesions about the optic nerves and chiasm were not the cause of the optic-nerve degeneration in the majority of cases.

Patients in whom examination of the spinal fluid is positive for syphilis should have a yearly study of the visual field. Even though the discs may appear normal, early narrowing of the field would justify a diagnosis of beginning syphilitic primary optic atrophy. Corrective therapy for vitamin deficiency is considered of no importance in this disease.

Francis M. Crage.

Dansey-Browning, G. C., and Rich, W. M. **Ocular signs in the prisoner of war returned from the Far East.** *Brit.*

Med. Jour., 1946, v. 1, Jan. 5, p. 20. (See Section 17, Systemic diseases and parasites.)

Knapp, A. A. The eye as a guide to latent nutritional deficiency diseases; a clinical study of ocular diseases at an advanced base hospital in the Southwest Pacific. Bull. New York Acad. Med., 1946, v. 22, April, p. 217. (See Section 17, Systemic diseases and parasites.)

Ridley, Harold. Ocular manifestations of malnutrition in released prisoners of war from Thailand. Brit. Jour. Ophth., 1945, v. 29, Dec., pp. 613-618. (See Section 17, Systemic diseases and parasites.)

Sautter, Hans. Spotted typhus and eye. Klin. M. f. Augenh., 1943, v. 109, Jan.-Feb., p. 24. (See Section 17, Systemic diseases and parasites.)

12

VISUAL TRACTS AND CENTERS

Chambers, D. L. Gunshot wound of both orbits. Lancet, 1946, Jan. 19, p. 93. (See Section 16, Injuries.)

Hughes, E. B. C. Indirect injury of the optic chiasma—a case report. Brit. Jour. Ophth., 1945, v. 29, Dec., pp. 629-632.

A case of indirect injury to the optic chiasma in which operative and pathologic inspection was made, is reported. The patient, a man aged 45 years, sustained a severe craniocerebral injury as the result of an accident in which he struck his head against the windshield of a truck. There was no scalp wound but severe bruising of both orbits and frontal regions. X-ray films showed a horizontal fracture above the frontal

sinuses, with extensions vertically downwards into the right frontal sinus and into the roof of the left orbit. A posttraumatic amnesia of 24 hours' duration and a lumbar puncture, soon after injury, that showed a small amount of blood and some 60 cells per cu. mm. in the cerebrospinal fluid, indicated the severity of his cerebral injury. The neurologic signs at the time of hospital admission consisted of bilateral anosmia, loss of taste, complete facial paralysis on the right side, and a mild hemiparesis on the left side with increase of tone and of the deep reflexes. The optic discs were abnormally pale in each eye; visual acuity O.U. was 6/9, and there was complete loss of the temporal visual field in each eye.

At the time of operation for repair of the dural defect near the right frontal sinus, an excellent view of the chiasma and of both optic nerves was obtained. No gross lesion was found. No change in the appearance of the fundi or fields had occurred four months after the injury.

The author believes that the small vessels of the chiasma were damaged by stretching and that the injury to the nerves was probably secondary to this disturbance. (3 illustrations, references.)

Edna M. Reynolds.

Macaskill, J. A case of occipital lobe injury. Brit. Jour. Ophth., 1945, v. 29, Dec., pp. 626-628. (See Section 16, Injuries.)

13

EYEBALL AND ORBIT

Paul, Milroy. Cavernous hemangioma of the orbit successfully removed by Shugrue's operation. Brit. Jour. Ophth., 1946, v. 30, Jan., p. 35.

On a patient presenting a marked

monocular protrusion of six months' duration, a large temporo-frontal scalp flap was made. The outer rim and lateral wall of the orbit were removed and a tumor, the size of a marble, was seen within the muscle cone. It was easily shelled out and removed. The wound was closed with a minimum of deformity, and the only sequela was a limitation of lateral movement of the eye. The tumor was found to be a cavernous hemangioma. There had been surprisingly little bleeding after its removal. This method is the Shugrue operation described in Spaeth's "Ophthalmic surgery." Morris Kaplan.

Rycroft, B. W. Sub-conjunctival penicillin and intraocular infection. Brit. Jour. Ophth., 1945, v. 29, Oct., pp. 501-511. (See Section 2, Therapeutics and operations.)

14

EYELIDS AND LACRIMAL APPARATUS

Callahan, Alston. The removal of adjacent nevi of the eyelids. Amer. Jour. Ophth., 1946, v. 29, May, pp. 563-565. (7 figures.)

Chi, H. H. Herpes zoster ophthalmicus. West China Med. Bull., 1945, v. 2, June 15, p. 61.

After reviewing the literature in brief, the author describes the characteristic symptoms and signs in five patients. Aside from symptomatic treatment, diphtheria antitoxin was administered. The anti-toxin injections alleviated pain and improved the skin condition in 24 to 72 hours. The course of the disease was shortened, and was not followed by neuralgia. (References.) China Medical Journal.

Donahue, H. C. Complications of herpes zoster ophthalmicus. Amer. Jour. Ophth., 1946, v. 29, May, pp. 582-585.

Fox, S. A. Some methods of lid repair and reconstruction. Amer. Jour. Ophth., 1946, v. 29, April, pp. 452-458. (6 figures, references.)

Friedman, B., and Gernand, H. Sjögren's syndrome treated with stilbestrol. California and Western Medicine, 1946, v. 64, Jan., p. 31. (See Section 5, Conjunctiva.)

MacLean, A. L. Sjögren's syndrome. Johns Hopkins Hospital Bull., 1945, v. 76, May, p. 179.

Deficient lacrimation may produce a troublesome keratoconjunctivitis. The patients complain of burning, pricking, and smarting of the eyes, and occasionally of diminished visual acuity. There is a stringy discharge. The cornea often can be stained, and fine epithelial filaments may be present. There is swelling of the parotid gland and dryness of the mouth, nose, and eyes. Schirmer's test shows deficient tear production. The differential diagnosis and the theories of etiology are discussed.

The treatment consists of the use of parasympathetic stimulating agents to increase glandular secretion; the instillation of collyriums and, best of all, the occlusion of the canaliculi. Three cases of Sjögren's syndrome are described. Robert N. Shaffer.

Mattsson, Ragnor. A grain of rye as a foreign body in the upper lacrimal canaliculus. Acta Ophth., 1942, v. 20, pts. 3-4, pp. 307-309.

A farmer 27 years of age, had a purulent discharge from the right lacrimal sac, which was not relieved by a dacryocystectomy. When he was examined

a grain of rye, surrounded by granulation tissue, was found imbedded in the upper lacrimal canaliculus. After its removal, the patient had no further difficulties. It is assumed that it entered through the nose, and was forced upwards through the lacrimal sac by violent blowing of the nose. (Illustration.)

Ray K. Daily.

15

TUMORS

Claus, S. **Nevogenous pterygium.** *Klin. M. f. Augenh.*, 1943, v. 109, Jan.-Feb., p. 59. (See Section 6, Cornea and sclera.)

Goodman, E. G., and Iverson, L. **Chloroma, a clinico-pathologic study of two cases.** *Amer. Jour. Med. Sci.*, 1946, v. 211, Feb., p. 205.

Two patients with chloroma, both presenting symptoms and signs of a rapidly growing tumor producing extreme exophthalmos, are described. The hematologic picture was identical with that of an acute myelogenous (myeloblastic) leukemia. Chloroma may be present as small, well-circumscribed nodules, or as large, solid masses with particular predilection for meninges, periosteum, mucous membranes, endothelium, or mesothelium. The exact chemical nature of the green pigment has not been demonstrated either by spectroscopic or by polariscopic studies. It may be an intermediary product in the breakdown of hemoglobin to bilirubin. R. Grunfeld.

Mao, W. S. **Adrenal neuroblastoma.** *West China Med. Bull.*, 1945, v. 2, June 15, p. 40.

Only two cases of adrenal neuroblastoma have been reported in the Chinese literature. The case herein reported was in a child, aged three years,

first seen in the Pediatric Service of the United Hospital of the Associated Universities in Chengtu. The chief complaints were abdominal pain and swelling of the left eyelids. Subsequent examinations showed bilateral ecchymosis of the lids with exophthalmos, subconjunctival hemorrhage, and retinal hemorrhage in the left eye. General physical examination revealed lymphadenopathy, hepatomegaly, splenomegaly, and anemia. Finally the child died at home. (References.)

China Medical Journal.

Paul, Milroy. **Cavernous hemangioma of the orbit successfully removed by Shugrue's operation.** *Brit. Jour. Ophth.*, 1946, v. 30, Jan., p. 35. (See Section 13, Eyeball and orbit.)

Paulo Filho, A., and Sebas, S. R. **Two cases of preëpitheliomatous dyskeratosis of the cornea and conjunctiva (Bowen's disease).** *Rev. Brasileira de Cirurgia*, 1945, April (reprint).

More or less closely related to molluscum contagiosum and Paget's disease, this condition has often been called atypical chronic epithelial proliferation, and is included in the precancerous dermatoses. Clinically it appears in the form of nodules on the bulbar conjunctiva, vascular and slightly elevated, united to one another by areas of lesser density. Microscopically the epidermis presents a disorderly arrangement of cells of unequal size, with nuclei which may be large or small, clumped, fragmented, or multiple. The condition may invade the cornea, to which, however, it is loosely attached. The treatment is excision, but it may easily occur that some cells are left in place and lead to recurrence. (6 photomicrographs, references.)

W. H. Crisp.

White, J. P. **Haemorrhage from the conjunctiva.** Notes on a case of capillary angioma. *Brit. Jour. Ophth.*, 1945, v. 29, Dec., pp. 635-637. (See Section 5, Conjunctiva.)

16

INJURIES

Chambers, D. L. **Gunshot wound of both orbits.** *Lancet*, 1946, Jan. 19, p. 93.

An American soldier with a healed septic wound located in the outer half of the left infraorbital margin was admitted to the British Prisoners-of-War Hospital in February, 1945, after having been treated at various German hospitals. The vision in each eye was 6/24. Both eyeballs were intact but were not in normal position. There was some limitation of ocular movement and diplopia in all fields. X-ray examination revealed a foreign body the dimensions of which were 35 by 20 by 3 mm. and which was lodged transversely in the nose and encroached on both orbits. Removal by way of the left orbit was followed by healing by first intention, though the left antrum was filled with mucoid pus. The diplopia and limitation of movement remained but vision improved to 6/12.

Francis M. Crage.

Dansey-Browning, G. C. **Ophthalmic treatment in the field, 1943.** *Brit. Jour. Ophth.*, 1946, v. 30, Jan., p. 26.

The author reports his observations on 148 wounded eyes of 129 men who were injured in the Italian campaign. Thirty-nine eyes were lost; of these 22 were hopeless at first examination. About 30 percent of the foreign bodies from German missiles were found to be magnetic. The injuries and their treatment are described individually. The liberal use of penicillin and sulfon-

amides both locally and generally is a tremendous advance in treatment. A plea is made for the "coal scuttle" type of helmet as a defense against ocular injuries.

Morris Kaplan.

Essen-Möller, Lars. **Transitory blindness after nonperforating injury to the skull.** *Acta Ophth.*, 1940, v. 20, pts. 3-4, pp. 272.

Two cases are reported. A six-year-old boy was blind for three days following a blow on the head and a short loss of consciousness. The pupillary reactions were normal. After a steady improvement in vision and in his general condition for a week, the child suddenly became unconscious, developed left-sided epileptiform spasms, with conjugate deviation to the opposite side. An exploratory craniotomy was performed because intracranial hemorrhage was suspected but none was found. The day after the operation the child was lucid and his vision was good. He was found normal on reexamination 3½ months later.

A girl, 15 years old, fell on the gymnasium floor. Six weeks after the injury she developed general neurologic symptoms, indicative of an intracranial lesion. The visual disturbances consisted of loss of visual acuity, horizontal and lateral nystagmus, outward deviation of the left eye, and slight ptosis on the left side. The fundus was normal in each eye. An exploratory craniotomy was performed through the left mastoid, because of a fracture line on the X-ray film behind the mastoid process. No abnormality was found, but the operation was followed by a rapid recovery from all symptoms.

These clinical pictures are attributed to vasomotor cerebral disturbances, caused by cerebral contusion.

Ray K. Daily.

Geller, K. Late traumatic rosette after contusion with a Vossius ring opacity. *Klin. M. f. Augenh.*, 1943, v. 109, Jan.-Feb., p. 105. (See Section 9, Crystalline lens.)

Hughes, E. B. C. Indirect injury of the optic chiasma—a case report. *Brit. Jour. Ophth.*, 1945, v. 29, Dec., pp. 629-632. (See Section 12, Visual tracts and centers.)

Kraus, J., and Briggs, W. A. Intraocular foreign bodies. Problems of localisation and operative procedure. *Brit. Jour. Ophth.*, 1945, v. 29, Nov., pp. 557-579.

A new system of localization of radio-opaque intraocular foreign bodies is described in detail as well as an improved operative technique in stages. This method gives the position of the foreign body in the particular globe to be operated upon and also the exact position on the sclera where the incision must be made to be in closest proximity to the foreign body.

The principles of magnetism as related to the success of extracting a foreign body from the eye are discussed, and a method of regulating the diathermy apparatus to avoid complications is outlined.

A diagram of a new forceps for the extraction of nonmagnetic foreign bodies is given. (27 illustrations.)

Edna M. Reynolds.

Murphy, P. J., and Schlossberg, L. Eye replacement by acrylic manillofacial prosthesis. *The Military Surgeon*, 1945, v. 96, June, p. 469. (See Section 2, Therapeutics and operations.)

Macaskill, J. A case of occipital lobe injury. *Brit. Jour. Ophth.*, 1945, v. 29, Dec., pp. 626-628.

A case of injury to the right side of the back of the head in a soldier, 22 years of age, is reported. For one week after injury he could not see at all on the left side. Then objects far out on the left side became visible, but he was still aware of the blind area near the center of his vision on this side.

When examined three months after injury there was a healed depressed wound in the occipital region to the right of the midline. Both eyes were normal and had full vision. The peripheral areas of the visual fields were unimpaired, but there was a left-sided homonymous, hemianopic scotoma, with sparing of the fixation area. No other neurologic findings were present. X-ray studies showed several depressed bone fragments underlying the skull defect. Although the brain was penetrated to a considerable depth, consciousness was not disturbed. The initial loss of the whole field on the left side probably resulted from a functional disturbance of all the right visual area of the brain at the time of injury, and recovery commenced in that part of the field furthest from the injury. (Fields, references.)

Edna M. Reynolds.

Rycroft, B. W. Ophthalmology in the B.N.A. and C.M. forces. *Brit. Jour. Ophth.*, 1945, v. 29, Nov., pp. 594-607. (See Section 18, Hygiene, sociology, education, and history.)

Scheie, H. G., and Hodes, P. J. Injection of oxygen into Tenon's capsule. *Arch. of Ophth.*, 1946, v. 35, Jan., pp. 13-14.

Early in their experience, air, usually 6 c.c., was injected into Tenon's capsule, after which stereoscopic roentgenograms were made. Although the procedure was diagnostic and enabled one

to localize intraocular foreign bodies, it made hazardous any surgical intervention soon after the injection. The air in Tenon's capsule exerted external pressure on the eyeball and increased the incidence of loss of vitreous and prolapse of the iris. Because of this, carbon dioxide and then oxygen, both known to be absorbed more rapidly than air from tissues or closed spaces, were tried.

Air injected into Tenon's capsule was not absorbed completely for three to four days; most of it could still be seen at the end of 24 hours, and disappeared slowly thereafter. Carbon dioxide, on the other hand, was absorbed too rapidly to be effective as a contrast medium. Decreasing amounts of the gas were noted between the first and last exposure of a routine roentgenographic study. When, for technical reasons, the examination had to be repeated, there was barely enough carbon dioxide in Tenon's capsule to outline the globe.

Oxygen proved to be an ideal gas. It produced excellent visualization of the globe and was absorbed slowly enough to permit reexamination when necessary; yet the oxygen was absorbed fast enough to avoid the risk of vitreous escape at operation.

The oxygen was obtained from an ordinary oxygen tank with a sterile rubber tube which contained a cotton filter. The oxygen was allowed to flow through the tubing for several seconds, after which it was introduced directly into the barrel of the syringe through the point for attachment of the needle, displacing the plunger as it entered the barrel. The needle was then quickly applied and the injection carried out.

R. W. Danielson.

Scott, G. I., and Michaelson, I. C.
An analysis and follow up of 301 cases

of battle casualty injury to the eyes. *Brit. Jour. Ophth.*, 1946, v. 30, Jan., p. 42.

A rather complete array of facts and figures concerning 359 eyes injured in the Western Desert Campaign is presented, mostly in tabular form. Fifty-six eyes were enucleated within 2 to 3 days after injury; of the others, 190 had penetrating wounds, 52 had contused wounds, and 26 were injured by concussion. Grenades accounted for 25 percent of wounds, shells 24 percent, and gun shot 11 percent. Infection was minimal, whether penicillin or sulfonamides were used or not, and apparently these drugs were used very little. No cases of sympathetic ophthalmia occurred. Sixty-three percent of the men were returned to their units (loss of an eye did not make a man unfit for overseas service). Twenty percent had a final visual acuity of 6/12 or better, while 38 percent could only count fingers or less (half of this defective vision was probably due to cataract). Vitreous hemorrhage caused 60 percent of the defective vision below 6/60 and cataract 18 percent. Of the intraocular foreign bodies, 37 percent entered through the cornea, 33 percent the limbus and 25 percent the sclera. X-ray localization was accomplished by limbal rings sewed to the sclera. This method failed in only three cases, and in each the foreign body was behind the eye. Twenty eyes suffered double penetration, and retinal separation resulted in four of them. Concussion was much less destructive than contusion, and perforation was considerably more serious than either.

Morris Kaplan.

Struble, G. C., and Kreft, A. J. War injuries of the eyes and visual pathways. *War Med.*, 1945, v. 8, Nov.-Dec., p. 290.

In World War I wounds of the eyes formed eight percent of all injuries, although the exposed surface of the eyes is only one four-hundredths of the total surface of the body. No figures for the present war are available. Factors accounting for this high figure are listed, and the nonocular wounds which affect the visual pathways are described in some detail. In 1918, Lagrange described a set of "laws" showing a constant, almost mathematical relationship between the type of orbital wound and the resultant type of ocular lesion. These rules apparently are just as applicable today, and several case reports are presented which bear this out. A strong plea is made for field studies of every patient receiving penetrating wounds of the head.

Included in the article is an interesting discussion of ballistics of wounds. A 115-grain Springfield rifle bullet leaves the gun with a velocity of 2,700 feet per second and rotates on its long axis 3,000 times per second. As it enters tissue it wobbles, often as much as 90 degrees. Its wounding effect is roughly 20,000 horsepower. Morris Kaplan.

Zorab, E. C. War surgery of the eye in forward areas. *Brit. Jour. Ophth.*, 1945, v. 29, Nov., pp. 579-593.

A description of the work done in a mobile ophthalmic unit in the Mediterranean theatre of war is given and surgical procedures adopted in dealing with various eye injuries are outlined. An analysis of the 440 battle casualties requiring major operations between October, 1943, and October, 1944, is given. Twenty-eight and seven tenths percent of these eyes were irreparably damaged and removed. The brain was involved in 6 percent of the injuries and the accessory sinuses were involved

in 12 percent. Panophthalmitis supervened in only 2.5 percent. Of 208 repairable eyes, 80 percent contained intraocular foreign bodies. In 43 percent of these the foreign bodies were removed by magnet; 16.7 percent were removed by the anterior route, 14.4 percent by the posterior route, and 69 percent through the wound of entry. Intraocular foreign bodies were removed by means other than the magnet in 10.8 percent. In 46 percent the intraocular foreign body was not removed.

Edna M. Reynolds.

17

SYSTEMIC DISEASES AND PARASITES

Arce, J. L. G. The problem of diabetes in ophthalmology. *Bol. del Hosp. Oft. de Nuestra Señora de la Luz*, 1945, v. 3, Sept.-Dec., pp. 110-120.

This general review of the subject deals with conditions in the eye directly resulting from diabetes and with the care to be taken of diabetic patients who require ocular surgery.

W. H. Crisp.

Bietti, G. B. Fuller application of compulsory insurance against tuberculosis in the field of ophthalmology. *Trans. Soc. Oftal. Ital.*, v. 8, pp. 5-9.

Bietti urges greater use of tuberculosis sanatoriums in the treatment of ocular tuberculosis, especially in uveitis. Good results were reported from German and Swiss institutions from this treatment. Laws were passed in Italy in 1927, providing for insurance against tuberculosis and for the provision for such sanatoriums. From 0.5 to 2 percent of all clinic admissions are considered to be due to tuberculosis.

Favorable location of institutions, rest, good food, and removal from infected members of the family account for the better results of treatment of ocular tuberculosis. Eugene M. Blake.

Buxton, R. J. Retinal haemorrhages in aplastic anaemia. *Brit. Jour. Ophth.*, 1945, v. 29, Dec., pp. 632-635. (See Section 10, Retina and vitreous.)

Dansey-Browning, G. C., and Rich, W. M. Ocular signs in the prisoner of war returned from the Far East. *Brit. Med. Jour.*, 1946, v. 1, Jan. 5, p. 20.

Ocular studies were made on 30 prisoners who had suffered from dysentery (26 cases), malaria (15 cases), and beriberi (27 cases).

Ten cases of beriberi were discussed. The patients showed the following significant changes: Five had a color scotoma, and in five corrected vision was only 6/60. There was some pallor of the optic disc in both eyes of each patient; four had apparent primary optic atrophy, four showed pallor of the papillomacular bundle, and eight showed temporal pallor. In eight of the 10 patients there was evidence of bilateral retrobulbar neuritis, with a characteristic scotoma for white, but no peripheral constriction of the field or ocular-muscle paresis.

The author discusses the pathology, prognosis, and treatment of "dry" beriberi and vitamin deficiency.

There is a relationship between the scotoma of beriberi and that of toxic amblyopia. Deficiency of vitamins B₁ and B₂ plays a part in the ocular signs of beriberi, but the exact nature of the nutritional neuritis produced remains obscure.

The bilateral optic-nerve degeneration in this disease is more common

than the literature leads one to believe, and though increased vitamin-B₁ intake improves peripheral nerve symptoms, the damage to the optic nerve is permanent. Francis M. Crage.

Donegan, E. A. Ocular findings in tropical typhus. *Brit. Jour. Ophth.*, 1946, v. 30, Jan., p. 11.

Ocular findings in 101 cases of tsutsugamushi fever or scrub typhus in the India-Burma campaign are described. Conjunctival hyperemia, vitreous haze, mild hyperemia of the optic disc, and occasionally edema of the disc were seen. These signs persisted for two to three weeks and subsided.

Morris Kaplan.

Fanta, H. Eye lesions in spotted typhus. *Klin. M. f. Augenh.*, 1943, v. 109, Jan.-Feb., p. 11.

Fanta reports the ocular lesions observed in a large number of patients (no figures given) in an army hospital in Poland. They were examined systematically during the period of fever and during convalescence. These examinations proved, contrary to various previous communications, that eye lesions are very common in spotted typhus and that practically all parts of the eye can be involved. In the beginning and during the course of the fever eye complications are often overlooked because of the severity of the general disease, and the absence of subjective eye disturbances. The first symptom is a conjunctival injection, and secretion is almost invariably present. It does not respond to treatment but usually disappears toward the end of convalescence, although about 10 percent of all patients suffer from a certain catarrhal condition for several weeks. In 87 percent of all cases there was a typical roseolar

rash in the lower fornix. Corneal lesions do not occur during the fever period; epithelial lesions with slightly diminished visual acuity occurred in only two patients. Iritis was observed in four patients during convalescence. Cataract was not seen, but moderate vitreous opacities occurred quite frequently. A few days after the onset of fever noticeable engorgement of retinal veins could be observed almost invariably, and it persisted for a long time, whereas changes of arterial vessels usually were absent during that period. During convalescence the arteries often showed typical signs of hypertension (silver-wire arteries, differences in caliber) accompanied by general hypertension. Petechial retinal hemorrhages along retinal vessels, usually in the periphery of the fundus and never noticed by the patient, were common. Measurements of the blood pressure in the central retinal artery often showed a marked hypotension especially in patients with dimmed consciousness; this suggests connection with the encephalitic process which is often present. One patient suffered an extensive hemorrhage in the macula of one eye which caused a central scotoma and probably permanent damage. Blurring of the discs, starting during the fever period and often persisting through convalescence, was very common. In 40 percent of such patients the vision was moderately diminished and central scotoma for red and green was present. Fanta ascribes this defect to optic neuritis, in some of the patients, to true papilledema in others, and in some to a combination of both. Transient convergence pareses, often requiring prismatic corrections, occurred occasionally, and some doubtful cases of accommodative defects were observed. Dur-

ing the convalescent period many patients show a certain nervous irritability often accompanied by marked mydriasis, causing photophobia. Night blindness was never observed. (References.)
F. Nelson.

Grant, W. M. Ocular complications of malaria. *Arch. of Ophth.*, 1946, v. 35, Jan., pp. 48-54.

Dendritic, or herpetic, keratitis is believed to be the most frequent ocular complication of malaria.

A type of corneal lesion referred to by most authors is described as a monocular interstitial process with clouding of the stroma but without vascularization.

A major proportion of the ocular complications which have been described in association with malaria are due to vascular and neurologic lesions. Lesions that result in loss of vision and are evident ophthalmoscopically are optic neuritis, atrophy of the optic nerve, and degenerative or hemorrhagic lesions of the retina and choroid.

Malaria may incite several characteristic disturbances in various parts of the eye. The lesions are usually monocular but moderately incapacitating. The relatively frequent complication of herpetic keratitis is nonspecific and several of the disturbances appear to be best explained on the basis of vascular lesions attributable to the malarial parasites. Lesions of the choroid, retina, and optic nerve, which from histologic evidence appear to be due to emboli of parasitized cells and which are commonly bilateral, are the most serious of the complications, because of their interference with vision. Treatment with antimalarial drugs has in general been successful in all the ocular disturbances except herpetic kera-

titis, which is caused by a virus, and for which specific chemotherapy is lacking.

R. W. Danielson.

Knapp, A. A. The eye as a guide to latent nutritional deficiency diseases: a clinical study of ocular diseases at an advanced base hospital in the Southwest Pacific. *Bull. New York Acad. Med.*, 1946, v. 22, April, p. 217.

A group of service men who had subsisted on a restricted diet, mostly canned foods, for 6 to 18 months in the Southwest Pacific, were studied. The most common complaint was impairment of vision, and homatropine refractions revealed axial myopia of +0.25 to +1.25 diopters. Many men complained of "inflamed eyes," and all were found to have mild vernal catarrh. The author implies that allergic conjunctivitis has a nutritional basis, and cites previous experiments in which this condition was helped by the use of calcium and vitamin D. A third complaint was "night blindness."

Objectively, the author noted blurring of the discs and a hazy fundus, but found normal blind spots, and normal perception of form and color. He believes that the fundoscopic findings mentioned may be signs of a latent deficiency state. In some patients enlargement of the blind spots with or without pallor of the disc was observed. The author ascribes these findings to retrobulbar neuritis, and states that the patients recovered after treatment of infectious foci and a nutritious diet. Chorioretinitis near the fovea was also reported; visual acuity in these patients was normal.

All the subjects of the study appeared healthy in other respects. Those with vernal catarrh, enlarged blind spots, pallor of the disc, and chorioretinitis are reported to have re-

sponded rapidly to diet. Neither the deficient diets nor the therapeutic diets which improved the patients were analyzed qualitatively or quantitatively.

Benjamin Milder.

Macaskill, J. Some ocular complications of scrub typhus. *Brit. Jour. Ophth.*, 1945, v. 29, Oct., pp. 537-540.

Scrub typhus is one of the typhus fevers endemic in Eastern Asia, due to larval mites that abound in areas of scrub jungle. The clinical features of the disease are fever, severe toxemia, headache, and prostration. Some patients become unconscious and others mentally disoriented. Diffuse glandular enlargement and a maculo-papular rash are common. The mortality rate is 10 to 15 percent. The Weil-Felix reaction is positive about the tenth day of the illness.

The essential pathologic change is a generalized vasculitis affecting the arterioles and smaller vessels. This results in destruction of the vessel walls with extravasation of blood into the surrounding tissues and vascular blockage either by thrombosis or cellular infiltrations. The lesions are patchily distributed throughout all organs and the central nervous system. Generalized congestion of the brain and meninges is commonly seen at post-mortem examination.

The ocular complications of 70 cases occurring in Assam are reviewed. Congestion of the conjunctiva occurred invariably in the acute phase of the disease. Subconjunctival hemorrhages were seen in four cases; in one there were extensive bilateral hemorrhages. Marked engorgement of the retinal vessels was noted in seven cases. Papilledema was present in four patients, and was bilateral in three of them. In these three there was an in-

crease in intracranial pressure associated with an increase in the protein content of the cerebrospinal fluid. Retinal hemorrhages occurred in four cases. One case of bilateral optic atrophy was seen six months after the acute stage of illness.

The visual fields of the patient with optic atrophy are given and the course of his illness is described. The author believes that the optic atrophy was toxic in origin, and he mentions that many patients have a nerve deafness, that is probably also toxic in origin. (Fields.) Edna M. Reynolds.

Miller, C. D., and McIntyre, D. W. A syndrome termed Reiter's disease (urethritis, conjunctivitis, and arthritis). *Ann. Int. Med.*, 1945, v. 23, Oct., p. 673. (See Section 5, Conjunctiva.)

Posner, M., and Horrax, J. Eye signs in pineal tumors. *Neurosurgery*, 1946, v. 3, January, p. 15.

Pineal tumor is rare. Its symptoms resemble closely those of cerebellar neoplasm. An exact evaluation of characteristic eye signs and ventriculograms, however, lead to an early, correct diagnosis. Subtemporal decompression followed by irradiation is satisfactory therapy.

Compression and obstruction of the aqueduct of Sylvius will cause headache, nausea, vomiting, and papilledema. Pressure of the tumor on the corpora quadrigemina results in central deafness and gives rise to the following eye signs; (1) impaired pupillary reactions; (2) limitations of extraocular movements, especially conjugate movements upward; (3) nystagmus; (4) strabismus. Pressure on the tentorium gives rise to cerebellar signs. General examination often reveals endoc-

rine dysfunction in the form of macrogenitosomia praecox, diabetes insipidus or dystrophia adiposogenitalis.

In 16 cases of pineal tumor, dilated pupils were present in 31 percent; there was impaired reaction to light in 50 percent; reaction of the pupils in accommodation was impaired in 12 percent; papilledema was present in 56 percent; and upward gaze was limited in 31 percent. R. Grunfeld.

Ridley, Harold. Ocular manifestations of malnutrition in released prisoners of war from Thailand. *Brit. Jour. Ophth.*, 1945, v. 29, Dec., pp. 613-618.

A report of the examinations of the eyes of 500 released allied prisoners of war and internees from Thailand, whose sight had deteriorated during captivity, is given. The food was inadequate in quantity and deficient in protein, fats, and vitamins. The three daily meals were the same and consisted almost entirely of carbohydrates. From October, 1942, to March, 1943, everyone was forced to labor from dawn to dusk on building the Bangkok-Moulmein railway. The food was reduced to starvation level, and for a time only rice and salt were supplied. Most of the visual disorders originated during or shortly after this period.

One hundred of these patients were amblyopic. In many of them the onset was sudden, and maximum disability was reached within a single day, but in others it was gradual, taking months to develop. Rather surprisingly there were few complaints of hemeralopia. Intercurrent infections tended to precipitate amblyopia. Many patients with amblyopia also suffered from pellagra, edema of the legs, beriberi, sore tongue, and perleche. Quite a high proportion of the amblyopic were also nerve deaf. There were 48 cases of optic

atrophy and 30 were regarded as doubtful. In some instances of severe and prolonged amblyopia, no abnormalities were visible.

Campimetry in 90 patients revealed a small, sharply demarcated central scotoma, very dense but rarely more than 3 degrees and often only 1 degree or less from the fixation point. In the majority of these cases, there was a history of considerable improvement during captivity.

Practically all the released prisoners showed some degree of keratoconjunctival abnormality. In 96 percent of the amblyopic patients and in 91 percent of the other patients there was limbal vascularization accompanied by opacification. The limbal capillaries frequently formed aneurysms so large that they could be mistaken for hemorrhages.

All the ex-prisoners were unduly presbyopic.

Amblyopic patients are still arriving at the rate of about five in a day, and it is possible that 1 percent of the survivors from Japanese prison camps may be permanently disabled by defective sight.

Edna M. Reynolds.

Rosen, Emanuel. Diabetic needles. *Brit. Jour. Ophth.*, 1945, v. 29, Dec., pp. 645-653. (See Section 9, Crystalline lens.)

Semadeni, B. Histological findings in a patient with numerous microfilarias in both eyes. *Klin. M. f. Augenh.*, 1943, v. 109, Jan.-Feb., p. 35.

A man, 39 years of age, who had spent the years 1936 and 1937 in the Sudan and Algeria, developed burning and redness of the eyes, zoster-like skin eruptions that suggested herpes zoster, disturbances of temperature sense, swellings about nose and ears, diarrhea,

and night sweats. In 1939, an eosinophilia of 28 percent was detected and a slitlamp examination revealed about 300 live microfilarias, 0.2 mm. in length, in the anterior portion of the parenchyma of each cornea. Five to 20 of the parasites could be observed in active movement in the aqueous, especially after exposure of the eye to light (positive phototropism.) In excised pieces of skin from the ear and neck the parasites could be identified histologically as larvae of *Onchocerca volvulus*. Nowhere could the adult parasites be detected. Various therapeutic measures were applied unsuccessfully. The patient died after an accident in October, 1941. Histologic examination of the eyes showed cellular infiltrations in the cornea, conjunctiva, episclera, and the superficial layers of the sclera; also a little in the ora serrata and the choroid. The parasites are most numerous in the eye where lymph spaces are found.

F. Nelson.

Sautter, Hans. Spotted typhus and eye. *Klin. M. f. Augenh.*, 1943, v. 109, Jan.-Feb., p. 24.

The clinical records of two patients with simple unilateral incomplete optic atrophy with contraction of visual fields after spotted typhus are reported. The histologic findings in three pairs of eyes enculeated *post mortem* are also reported; the conjunctiva was hyperemic, there was subepithelial, cellular lymphocytic infiltration, and an increase in number of beaker cells. Similar cellular infiltration was found in the iris and ciliary body, but there was no exudation into the anterior chamber and vitreous body. In all specimens the choroid was hyperemic, thickened, and massively infiltrated, chiefly in the choriocapillaris. There were incipient thrombi in some veins. Invariably a

strong cellular infiltration was found in the optic nerve and its sheath, and papilledema, which spread into the retina. The latter was hyperemic in the vicinity of the nerve head. Hemorrhages and other changes were usually absent in the retina. An infiltrative retinal focus was found in only one eye. The muscles also showed small-celled interstitial, perivascular infiltration. (References.) F. Nelson.

Sen, K., and Ghose, N. Ocular gnathostomiasis. *Brit. Jour. Ophth.*, v. 29, Dec., 1945, pp. 618-626.

A case of gnathostoma in the human eye is reported. A brief description of the life cycle and habitat of the worm is given.

The patient was a Hindu Brahmin, 26 years of age, who was admitted into the Eye Infirmary for treatment of orbital cellulitis with hemorrhages in the retina and the vitreous of his left eye.

He reported that 10 days before admission he had felt a dull aching pain on the left side of his nose. The next day the pain increased, and an itching swelling appeared on the left cheek and lower eyelid. It increased until he could not open his left eye.

Examination revealed chemosis of the conjunctiva and restriction of movements of the eyeball. The pupil was dilated and reacted to light sluggishly. The tension was normal, and the vision 6/6. The right eye was normal. Two days later the swelling of the lids and the chemosis of the conjunctiva had almost disappeared, but the pain was more severe in the eye, and the vision was reduced to perception of hand movements. The fundus showed a hazy vitreous with engorgement of the retinal veins and hemorrhages in the retina. The patient was admitted to the hospital. General examination re-

vealed a moderate anemia and slight eosinophilia. He developed an iritis which responded to the usual treatment, but later the iritis recurred with increased tension and one of the nodules in the iris was seen to be moving. Slitlamp examination showed the presence of a worm in the eye. This was removed and found to be about 4 mm. long and completely covered with iris pigment.

When it was possible to see the fundus, a circular gray area below the macula was made out, probably the site of the worm's entrance into the eye.

The patient made an uneventful recovery but optic atrophy developed. (3 illustrations, references.)

Edna M. Reynolds.

Thannhauser, S. J. Werner's syndrome (Progeria of the adult) and Rothmund's syndrome; two types of closely related heredofamilial atrophic dermatoses with juvenile cataracts and endocrine features. *Ann. Int. Med.*, 1945, v. 23, Oct., p. 559. (See section 9, Crystalline lens.)

Zeeman, W. P. C. Gargoylism. *Acta Ophth.*, 1942, v. 20, pt. 1, pp. 40-47.

A child, aged 6½ years, with gargoylism came to autopsy. The lesions in the central nervous system resembled those of amaurotic family idiocy. The corneal lesion, which is described in detail, is strikingly similar to that reported by Berliner, in 1939, under the name of lipin keratitis of Hurler's syndrome (6 photomicrographs).

Ray K. Daily.

18

HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Ayesworth, F. A. Causes of blindness in over 12,000 cases. Canadian

Med. Assoc. Jour., 1946, v. 54, Jan., p. 30.

In this blind population the visual acuity varies from no light perception to 6/60. The latter is the upper limit for economic blindness accepted by the pension authorities.

Both topographic and etiologic classifications are given. Glaucoma is the cause of the largest number of cases of blindness and myopia of the second largest. Numerous other causes are mentioned.

The author suggests that every individual between the ages of 40 and 50 years undergo an examination under a cycloplegic for early diagnosis and prophylaxis against blindness.

Francis M. Crage.

Fishenden, R. B. Types, paper, and printing in relation to eyestrain. Brit. Jour. Ophth., 1946, v. 30, Jan., p. 20.

A description of the various types of lettering used in printing (in England) and of the effects of various kinds of paper on legibility is presented. Some of the details of the lettering are analyzed. No definite conclusions as to the effect on eyestrain or on vision seem to have been reached.

Morris Kaplan.

Fox, M. J., and Bortin, M. M. Rubella in pregnancy causing malformations in newborn. Jour. Amer. Med. Assoc., 1946, v. 130, March 2, pp. 568-569.

The writers' investigation is based on the records of the Public Health department of the city of Milwaukee. It covers a 3-year period and includes all married women who were pregnant at the time they had rubella. The results of investigations of the occurrence of congenital malformation in babies born by mothers who had rubella in the early months of pregnancy appears

in tabulated form. The writers state that their records do not justify the termination of pregnancy in women who have rubella. The occurrence of congenital malformations in virus diseases in pregnant women is, however, a subject worthy of further careful investigation.

M. Lombardo.

Hathaway, Winifred. The partially seeing child in 1950. Sight-Saving Rev., 1945, v. 15, Fall, p. 156.

The author sees much hope for the visually handicapped child, whose number will probably decrease now that most states have sane premarital and prenatal laws. Interstitial keratitis and ophthalmia neonatorum may be expected to disappear, and with sulfonamides, penicillin, and corneal transplants widely used few children should be sightless. Increased research in nutrition and in lighting should also bring benefit. Better training of teachers is predicted, and increased use of sound and radio in teaching should make the education of the visually handicapped equal to that of the normal child.

Morris Kaplan.

Henderson, J. W. Overseas ophthalmology. Amer. Jour. Ophth., 1946, v. 29, May, pp. 551-562.

Nicholls, J. V.V. Ophthalmic status of Cree Indians. Canadian Med. Assoc. Jour., 1946, v. 54, April, p. 344.

Three hundred Cree Indians, of Northern Manitoba, were surveyed to determine the type and frequency of ocular diseases. These people are subjected to prolonged exposure to cold and wind, and subsist on a diet poor in fresh vegetables, dairy products, and meat. The most frequent abnormality was pterygium, and its incidence increased with each decade. Pinguecula was common; retinal arteriosclerosis

was rare. A relatively greater incidence of visual defects among the adults of the group, as compared with other adult groups, was ascribed to the higher percentage of organic ocular disease.

Benjamin Milder.

Minton, Joseph. *The one-eyed worker*. *Sight-Saving Rev.*, 1945, v. 15, Fall, p. 161.

One-eyed people are divided into two groups: those who have lost an eye in childhood, and those who have lost an eye in adult life through disease or injury. The first group is not handicapped, whereas the second group has much readjusting to accomplish. Most men interviewed (at the Royal Eye Hospital, London) had lost an eye while hammering, chipping, boring, or milling. The most difficult part of readjustment was that involving depth perception, although all, sooner or later, apparently overcome this problem. If the lost eye was the dominant eye the problem is greatly exaggerated; it is equally minimized if the dominant eye is retained. The author discusses reemployment opportunities and stoutly insists that, although the one-eyed worker is actually fit for most jobs, the safety of the remaining eye should be the first consideration, and he should certainly not be returned to his previous job if the likelihood of injury remains.

Morris Kaplan.

Queiroga, Geraldo. *Teaching of ophthalmology in the United States*. *Rev. Brasileira de Oft.*, 1945, v. 4, Dec., pp. 77-88. (See *Amer. Jour. Ophth.*, 1946, v. 29, p. 512.)

Rycroft, B. W. *Ophthalmology in the B.N.A. and C.M. forces*. *Brit. Jour. Ophth.*, 1945, v. 29, Nov., pp. 594-607.

A description of the military admin-

istration of the campaign in North Africa is given. The ocular diseases related to the terrain and the subtropical climate of North Africa are discussed, and methods of treatment are outlined. The treatment of battle casualties is also described.

The changes made in the ophthalmic and optical services in the campaign in Sicily and Italy are described, and the memorandum which was issued to medical officers for the preliminary care of ophthalmic cases is given together with the general and special instructions to medical officers for the care of eyes.

The Livingstone hand electromagnet and a portable giant-magnet stand, as well as the antimine perspex visor, are examples of the successful research that was carried out during the campaigns.

In the Sicilian and Italian campaigns the giant magnet was applied to all penetrating wounds of the eye as soon as possible after injury. In this way, 50 to 60 percent of all magnetizable foreign bodies were removed in good time.

Deep intraocular infections were treated with penicillin, which is a great advance in the prevention and treatment of ocular sepsis.

The Lister frill excision for disorganized eyes was carried out when these were seen at an early stage. At later stages, enucleation with the implantation of a 14-mm. perspex globe in Tenon's capsule was done. The old evisceration operation was practically discarded, and enucleation alone was very infrequent. To clean up dirty sockets, 2-percent silver nitrate paint and penicillin together with adhesive straps on the upper lid to allow the ingress of air proved very successful. (5 illustrations.) Edna M. Reynolds.

"Screening," eye examinations, and follow-up. *Sight-Saving Rev.*, 1945, v. 15, Fall, p. 132.

A comprehensive public-health eye program for large groups is presented. The program includes early discovery through periodic screening of groups of individuals, comprehensive eye examination for each one who seems to have any visual or eye difficulty, and a follow-up system to aid in securing eye examinations and in carrying out recommendations.

Screening tests suggested are: Snellen test for distance, plus-lens test for hyperopia, tests for near vision, rough

visual fields, muscle balance, color vision, depth-perception tests, and stereoscopic-vision test. That the accomplishment of all these on all the people would be extremely difficult is admitted, but it is an ideal to strive for.

Morris Kaplan.

19

ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Kiss, F. The blood circulation of the eye. *Ophthalmologica*, 1943, v. 106, Nov.-Dec., pp. 226-250. (See Section 7, Uveal tract, sympathetic disease, and aqueous humor.)

NEWS ITEMS.

Edited by DONALD J. LYLE, M.D.
904 Carew Tower, Cincinnati 2

News items should reach the editor by the twelfth of the month.

DEATHS

Dr. William Byron Agan, Brooklyn, New York, died February 5, 1946, aged 58 years.

Dr. M. Fullenwider, Muskogee, Oklahoma, died January 26, 1946, aged 67 years.

Dr. Edward Stieren, Pittsburgh, Pennsylvania, died January 8, 1946, aged 72 years.

Dr. James Watson White, Albany, New York, died May 15, 1946, aged 69 years.

MISCELLANEOUS

Four scholarships for the advanced study of eye diseases at New York University College of Medicine will be provided annually by the Lions Club of New York, it was announced May 14th. The scholarships will be valued at \$500 each and will be available to four graduate medical students to be selected by the department of ophthalmology of the medical school, enabling them to have a year of advanced study.

The Rochester Orthoptic Center is receiving applications for its next training course for orthoptic technicians. This course is accredited by the American Orthoptic Council. Information may be received from the Rochester Orthoptic Center, 208 North Goodman Street, Rochester 7, New York.

The Post-Graduate School of the University of Southern California School of Medicine is presenting a six-months' basic course in ophthalmology starting May 20th. Dr. A. Ray Irvine, professor of ophthalmology, is director of the course; he is assisted by Drs. Maurice Beigelman, William Endres, and S. Rodman Irvine.

The entire first month was devoted to pre-clinical courses organized as follows: Anatomy, Dr. Paul R. Patek; Physiology, Dr. Douglas Drury; Pathology, Dr. Ernest Hall; Bacteriology, Dr. John F. Kessel; Pharmacology, Dr. Clinton Thienes; Biochemistry, Dr. Harry Deuel, Jr. During the *second month* mornings are devoted to Histopathology and afternoons to intensive work in Physiological optics.

The *3d, 4th, and 5th* months will stress Clinical ophthalmology and Refraction. Clinical instructors include: Drs. C. H. Albaugh, Louis Bloomberg, John Bullis, Daniel B. Esterly, Channing Hale, Deane C. Hartman, W. C. Irvine, Raphael Koff, George B. Landegger, John P. Lordan, Henry R. Nesburn, Robert A. Norene, M. W. Nugent, Stephen Popovich, Helen Preston, Alfred R. Robbins, Carroll Weeks, Clinton A. Wilson, Warren C. Wilson,

Miss Dorothy Franklin, Mr. Russell Stimson, and Miss Dorothy Bergin.

Dr. Dwight Trowbridge of Fresno will be responsible for the section on Neuroophthalmology. The *6th month* will be spent in review with emphasis on preparation for the American Board Examinations.

Problem cases in Refraction and Therapeutics will be presented. Among several nationally known ophthalmologists who will be available during this final month for short series of lectures are Dr. Phillips Thygeson and Dr. Meyer Wiener. Examinations will be given at the end of each month. Sixteen students are enrolled, all of them returned service men. Enrollment was limited mainly by restricted facilities for work in refraction. Coöperation of the administrative and eye staffs of the Los Angeles County General Hospital is appreciated as essential to the success of the course.

As the guest of Emory University, 155 ophthalmologists from 19 states gathered recently at a unique and outstanding ophthalmologic seminar honoring the memory of Dr. Abner Wellborn Calhoun.

The University invited six of the nation's prominent ophthalmologists to be its guest speakers during the three-day session opening April 4th. Their presence in addition to that of the other guests was testimony to the memory of Dr. Calhoun, the first teacher of ophthalmology in the South and an outstanding ophthalmologist until his death in 1910. He was a professor of ophthalmology and otolaryngology in the Atlanta Medical College, which later became affiliated with Emory University, and the University chose this unique seminar to honor his memory.

During the three days 15 papers on ophthalmologic subjects were presented. The guests were entertained at luncheons and dinners by the University, the Board of Trustees of Grady Hospital, and by the University's Department of Ophthalmology.

At the opening dinner, Dr. Frank B. Walsh, associate professor of ophthalmology at Johns Hopkins University, presented a paper on "Myasthenia gravis." Following was an address on "Medical ophthalmology" by Dr. Walter I. Lillic, professor of ophthalmology at Temple University.

The April 5th session opened at Grady Municipal Hospital with which Emory University is affiliated and at which it does most of its bedside medical teaching. Before an audience which

overflowed the new Colored Nurses' Auditorium, Dr. William Benedict, chief of the Eye Section of the Mayo Clinic, presented a paper on "The clinical meaning of exophthalmos."

A noon recess permitted the entire group to inspect the Emory University department of ophthalmology at Grady Hospital, including the well-organized Colored Eye Department and the eye clinic in the white section. They also inspected the complete eye pathologic laboratory, one of the first in the South. The department has a chief, four assistant professors, four instructors, plus one full-time instructor; it is combined with ear, nose, and throat work. (Its three-year service with six men on the services gives outstanding training to its graduates.)

At the Academy of Medicine, Dr. Derrick Vail, professor of ophthalmology at Northwestern University, presented his paper on "Eye changes in diabetes," followed by Dr. Frank B. Walsh speaking on "Naso-pharyngeal tumors."

After a dinner as guests of Emory University, the 152 attendants heard Dr. Parker Heath, professor of ophthalmology at Wayne University, deliver a paper on "Ocular therapeutics in glaucoma." He was followed by Dr. John Dunnington, professor of ophthalmology of the College of Physicians and Surgeons, Columbia University, whose subject was "The treatment of detachment of the retina."

On the final morning Dr. Benedict spoke on "Glaucoma in diabetes," and Dr. Dunnington on the "Surgical treatment of the vertical deviations." The University's ophthalmology department was host at a luncheon.

Afternoon papers were delivered by Drs. Heath, Walsh, and Lillie. That evening Dr. Benedict spoke on "Preparation of the patient for cataract operation," and Dr. Vail on "The circulation of the optic nerve and its influence on disease."

The entire meeting was said to be remarkable in the uniformly high attendance by all guests. It was one of the rare seminars sponsored in the South by an entire university rather than exclusively by one individual or department.

The thirty-second annual meeting of the Oxford Ophthalmological Congress was held on July 4 to 6, 1946, at the Department of Human Anatomy, Oxford, by kind permission of Prof. Le Gros Clark. Accommodation was secured at Keble College, and the Warden kindly agreed to include lady members as residents in College. Members met informally at supper on Wednesday, July 3d, at 7:45 p.m. in the Hall of Keble.

The Congress opened with a discussion on "Amblyopia" led by Mr. Philip Jameson-Evans and Mrs. Dorothy Campbell. The Doane Memorial Lecture, entitled "The state of the retina in diabetes mellitus," was delivered by Prof.

Arthur J. Ballantyne. Facilities were provided in the Museum for demonstrations, and members were invited to bring forward cases, specimens, instruments, apparatus, and other matters, of ophthalmologic interest. Orthoptists were granted the privilege of attending the Congress as visitors on invitation of a member at sessions in which subjects affecting their department were discussed.

SOCIETIES

The following officers were recently elected by the New York Society for Clinical Ophthalmology: president, Dr. Benjamin Friedman; vice-president, Dr. Daniel Kravitz; recording secretary, Dr. Bernard Kronenberg; corresponding secretary, Dr. Benjamin Esterman; treasurer, Dr. Leon Ehrlich.

At its annual meeting on May 28, 1946, the Milwaukee Oto-Ophthalmic Society elected the following officers: president, Dr. Meyer Fox; vice-president, Dr. Frank G. Treskow; secretary-treasurer, Dr. Earl W. Mertens; directors, Drs. Ralph T. Rank, Thomas McCormick, and Herbert Schmidt.

The Reading Eye, Ear, Nose, and Throat Society has distributed its War Fund, both principle and interest, as outright gifts to its members who were in the Armed Forces. Each one was given \$644.

PERSONALS

Dr. Lawrence T. Post, professor and head of the department of ophthalmology, Washington University School of Medicine, St. Louis, delivered the Edward Jackson Memorial Lecture on April 19th at the University of Colorado School of Medicine, Denver, under the auspices of the Medical Society of the City and County of Denver. His subject was "Changing eyes in a changing world."

At the meeting of the Western Association of Industrial Physicians and Surgeons on June 30th, in San Francisco, Dr. Hedwig S. Kuhn of Hammond, Indiana, presented a paper on "Right eyes for the job."

Dr. David F. Gillette, professor of ophthalmology of Syracuse University College of Medicine, became professor emeritus on July 1st. Dr. Harold H. Joy has been appointed professor of ophthalmology to succeed him.

At a special session of the Minnesota Academy of Ophthalmology and Otolaryngology, at the 93d annual session of the Minnesota State Medical Association in St. Paul, on May 20th, Dr. Elmer A. Vorisek presented a paper on "Evaluation of the newer therapeutic agents in ophthalmology." This paper has been accepted for publication in the Journal.

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MUSTARD-GAS BURNS OF HUMAN EYES IN WORLD WAR II*

GEORGE I. UHDE, M.D.†

Portland, Oregon

Although chemical warfare was not used during World War II, useful information about chemical eye injuries nevertheless accumulated, mostly from experimental work but also from unfortunate factory, transportation, and training accidents.

The information presented herein was obtained from personal observation of casualties treated at Edgewood Arsenal over a period of two years and of casualties resulting from experimental, factory, training, and transportation accidents in the European Theater Operations during a subsequent period of 27 months.

Of 1,097 eye, ear, nose, and throat patients treated at Edgewood Arsenal during the 17 months preceding March 1, 1943, 1,008, or 91 percent, were due to mustard vapor. Of this latter number, 790, or 78 percent, had eye burns.

Only 80 out of 1,097 patients, or 7

percent, knew definitely their time of exposure. These 80 knew because of accidents, such as a sudden break in the shell-filling line releasing large quantities of mustard vapor which was detected by the sense of smell. In these 80 patients, the shortest interval between exposure and onset of symptoms was 2 hours, the longest 24 hours, with a mean of about 8 hours. The remaining 1,017, or around 93 percent, were due to exposure to slow leaks which were usually not detected by smell but, when detected, the sense of smell soon became dulled so that the workers were unaware of their danger.

CLASSIFICATION OF EYE BURNS

The following classification proved of practical value in the treatment and prognosis of casualties in fixed installations. It is believed this classification would be equally useful to medical officers in forward echelons where the problem is not so much a question of treatment and prognosis but simply as to whether a soldier is a casualty and should be evacuated for ophthalmic care.

GROUP 1: MILD CASES

- a. Symptoms: Gritty, foreign-body sensation; may have very slight lacrimation, but no true photophobia.
- b. Lids: May be slightly swollen, usually not.
- c. Conjunctival discharge: May have slight lacrimation.

* Presented as part of a lecture to classes attending the Medical Field Service School, American School Center, European Theater Operations, United States Army.

† Formerly Chief, E.E.N.T. Service Station Hospital, Chemical Warfare Center, U. S. Army, Edgewood Arsenal, Maryland, and Experimental Officer in Ophthalmology, Chemical Defence Experimental Station, Porton, England [Lt. Col. (MC) A.U.S.].

The author takes this opportunity to express his appreciation to Mr. R. Foster Moore, F.R.C.S., Comdr. E. B. Dunphy (MC) U.S.N.R., Prof. Ida Mann, Col. Derrick Vail, A.U.S., and Surgeon Capt. A. Fairley, R.N., for their kind and invaluable assistance on numerous occasions.



Fig. 1 (Uhde). Group I: Mild mustard-vapor burn, showing injection of only those conjunctival vessels normally exposed between the lids.

- d. Conjunctiva: Congestion of only the conjunctiva normally exposed between the lids (see fig. 1).
- e. Cornea: Clear, does not stain with fluorescein.
- f. Recovery: Spontaneous within five to seven days.
- g. Treatment: Not required, do not use a mydriatic.
- h. Duty: Full duty, do not evacuate.

GROUP II: MODERATE CASES

- a. Symptoms: Gritty, foreign-body sensation and may have slight lacrimation, photophobia, and blepharospasm.
- b. Lids: Slight to moderate swelling, able to open eyes.
- c. Conjunctival discharge: Slight to moderate lacrimation; may have slight mucopurulent discharge.
- d. Conjunctiva: Congestion of the whole conjunctiva, even that normally protected by the lids (see fig. 2).
- e. Cornea: Clear, but may have punctate staining with fluorescein.
- f. Recovery: Usually spontaneous within 7 to 14 days.
- g. Treatment: If cornea stains with fluorescein, dilate pupil with homatropine (in Negroes use atropine).
- h. Duty: Full duty if tactical situation

is bad, evacuate later; if tactical situation is good, evacuate after mydriasis is completed.

GROUP III: SEVERE CASES

- a. Symptoms: Severe, gritty, foreign-body sensation, ocular pain, lacrimation, photophobia, blepharospasm, blurred vision, and headache.
- b. Lids: Severe swelling, unable to open eyes voluntarily. Lids can be separated only a few millimeters (see figs. 3, 4, and 5).
- c. Conjunctival discharge: Severe lacrimation with slight to very severe mucopurulent discharge.
- d. Conjunctiva: Severe congestion, thromboses, hemorrhages, vessel variation in caliber and necrotic patches (stains yellow with fluorescein).
- e. Cornea: Gray, hazy, irregular, roughened ("orange peel"), band staining with fluorescein. Hypoesthesia.
- f. Recovery: Delayed at least weeks; may be subject to relapses with corneal vascularization; requires ophthalmic observation for months and perhaps years.
- g. Treatment: Atropine sulfate (1 percent), penicillin. Evacuate.



Fig. 2 (Uhde). Group II: Moderate mustard-vapor burn, showing injection of all conjunctival vessels, even those normally protected by the lids.

CLINICAL COURSE

The clinical course of a mustard-gas burn of the eye can perhaps be best shown by a case report illustrating each group in the foregoing classification.

GROUP I: MILD-CASE REPORT

A white woman, aged 22 years, was engaged from 3 p.m. to 5:30 p.m. in washing out bottles which had contained mustard. About 12:30 a.m. (eight hours after exposure) she was awakened with irritation, gritty foreign-body sensation, of both eyes.

Examination, 24 hours after exposure, showed slight reddening of the lid margins, injection of those conjunctival vessels normally exposed between the lids (fig. 1), and corneal epithelial flecks (best seen by slitlamp retroillumination and probably due to edematous swelling of individual epithelial cells). It is believed by some observers that these flecks are pathognomonic of exposure to mustard vapor.

The patient was asymptomatic four days after exposure, and the conjunctival injection and epithelial flecks disappeared three days later.

GROUP II: MODERATE-CASE REPORT

A white woman, aged 18 years, after

working for two days counting mustard-droplet-contaminated cards under a ventilator, developed grittiness, lacrimation, photophobia, and blepharospasm and was in considerable discomfort. She was wearing eyeshields. On awakening in the morning, she had difficulty in opening her eyes.

Examination, 36 hours after exposure, showed moderate swelling of the lids (fig. 2), difficulty in keeping her eyes open in bright light (photophobia), injection of all conjunctival vessels even those normally protected by the lids, and bedewing, but no staining, of the epithelium over the lower halves of the corneas.

The pupils were dilated and within three days the patient was comfortable. All signs disappeared by the 14th day.

GROUP III: SEVERE-CASE REPORT

A senior officer, aged 44 years, standing about two yards from two land mines (94 lbs. of mustard) which inadvertently detonated, felt a "watery-like," painless splash across his face and in both eyes. Both eyes were irrigated with normal saline about three minutes later but for only a few seconds. Ten minutes after the accident, his eyes were again irrigated with normal saline but again for only a few seconds.

Although his lids were swelling meanwhile, his first disturbing symptoms about the eyes appeared seven hours after the accident. They were lid edema, which was so severe that he was unable to open his eyes voluntarily, and lachrimation. Pain was present only when the lids were separated and the eyes exposed to light; this always caused profuse lachrimation,



Fig. 3 (Uhde). Group III: Severe mustard burn, showing profuse mucopurulent discharge and swelling of lids seven days after the eye was splashed with mustard.

severe pain, photophobia, and blepharospasm.

Twenty-four hours after the accident his eyelids were "stuck together" and could be separated only after irrigation with normal saline. Symptoms and signs remained unchanged.

Because of the severe skin burns, it was impossible to make a satisfactory slitlamp examination until the seventh day, at which time the following findings were observed: The lids were so swollen that it was almost impossible to examine the corneas. A slight mucopurulent discharge oozed between the lids of the right eye and a profuse discharge from the left eye (fig. 3). The bulbar conjunctival vessels varied considerably in caliber; that is some were so constricted and irregular that they could barely be seen with the slitlamp; others were engorged, with localized areas of laking of the blood

stream; these conditions were especially marked in the vessels normally exposed in the interpalpebral space. There was either a stagnation of the blood current or a thrombosis in these constricted vessels. The edema of the interpalpebral conjunctiva together with the constricted and thrombosed blood vessels with resultant necrotic patches produced a marbling effect. Conjunctival and subconjunctival hemorrhages were numerous. Some of the groups of limbus vessels were constricted, whereas others were congested; but not nearly to the extent seen in the superficial conjunctival vessels. The ciliary vessels were injected, especially those of the left eye. A band of bright green from fluorescein staining extended across both corneas, limited to the areas normally exposed in the interpalpebral fissures. The remaining corneal surfaces, however, stained a lighter and duller shade of green, indicating that the entire epithelial surfaces were damaged. The corneal reflex of the left eye was very irregular, because the surface was roughened and pitted (orange-peel or *peau d'orange*).

With the slitlamp, it was found the edema and infiltrates extended into the anterior third of the corneal stroma of the right eye and throughout all layers of the cornea of the left eye even including the endothelium. Correspondingly, the epithelium, Bowman's membrane, and the anterior third of the substantia propria of the right eye stained, while in the cornea of the other eye the stain extended down to and included part of the endothelium. The green stain did not appear to extend into the aqueous, although, because of the intense edema of the intervening corneal tissue, it was difficult to be sure of this or of the condition of the iris of the left eye.

The only obvious change during the second week was a gradual diminution of the mucopurulent discharge.

The patient was not able to open his

eyes until the third week. At this time, the conjunctival discharge was minimal. Although there was neither pain nor headache, there were complaints of blurred vision, lacrimation, photophobia, and blepharospasm of both eyes. Corneal sensation was diminished in both eyes, as it had been all along. The conjunctival vessels appeared unchanged. There were remains of conjunctival and subconjunctival hemorrhages in the right eye, and fresh hemorrhages appeared in the left. The newly regenerated corneal epithelium showed innumerable flecks and some hydrops, in contrast to the previous mass edema and bedewing.

During the fourth week the edema and congestion of the lids of the right eye improved considerably. Conjunctival congestion was minimal. Some of the superficial epithelial cells, however, showed flecks and hydrops. There was very little improvement in the left eye (figs. 4 and 5), compared with the results of the examination during the previous week.

There was gradual improvement but there were no significant changes during the fifth week.

On the fortieth day there was an early superficial vascularization of the cornea of

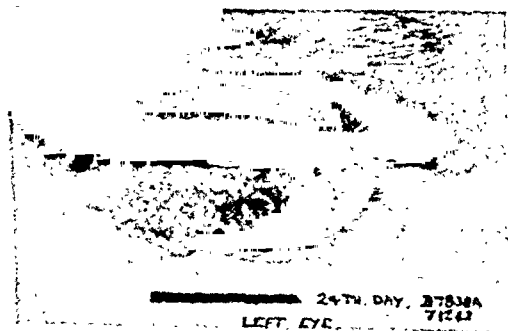


Fig. 4 (Uhde). Group III: Severe mustard burn of left eye 24 days after being splashed with mustard, showing profuse tearing and swelling of the lids even in the dark (monochrome reproduction from color transparency taken at one-seventy-fifth second in the dark. The camera lens was focused by dim flashlight).



Fig. 5 (Uhde). Group III: Severe mustard burn 24 days after the eye was splashed with mustard, showing lids involuntarily separated, engorged conjunctival and limbal vessels beneath the lids, and necrotic conjunctiva, with thromboses and hemorrhages beneath the interpalpebral space.

the left eye at the 8-o'clock position, as shown by the sprouting off of new capillaries from the limbal loops. This vascular invasion was preceded by a broad area of secondary edema and small hemorrhages but by no blood islets, at this time.

Infiltrates and edema were stratified in layers between the lamellae throughout the remaining corneal tissue. The superficial cells of the cornea of the right eye still showed flecks and an occasional hydropic cell. New blood vessels were found in the necrotic conjunctiva of both eyes.

On the fiftieth day this patient was transferred to the service of Prof. Ida Mann, The Eye Hospital, Oxford University. He will most likely require observation and treatment for many years.

COMPARISON OF THE CLINICOPATHOLOGIC FINDINGS IN CASUALTY AND NON-CASUALTY PATIENTS

The following findings are those observed in six eyes splashed with liquid mustard, and insufficiently irrigated with normal saline, and six eyes exposed to mustard vapor during a training accident. The splashed eyes were true battle cas-

ualties in the sense that the men were thereafter unable to fight; the vapor-exposed eyes were noncasualties. In none was there any pain whatsoever when the eyes were splashed, confirming the experience of those similarly injured in World War I. The mustard droplets felt like "watery" painless fluid. All the patients with splashed eyes complained of a severe, gritty, foreign-body sensation and of severe lacrimation, photophobia, blepharospasm, and blurred vision 3 to 24 hours after exposure. Two of these patients complained of headache; there were no signs of iritis.

One of the patients with vapor-burned eyes complained of a gritty, foreign-body sensation and two complained of gritty, foreign-body sensation and lacrimation about seven hours after exposure. One patient complained of mild photophobia. Three patients, although asymptomatic, had signs of a vapor burn.

TABLE 1

COMPARISON OF SYMPTOMS IN SIX CASUALTY
AND SIX NONCASUALTY MUSTARD-
EXPOSED EYES

Symptoms	Casualty		Non-casualty*	
	No.	Per-cent	No.	Per-cent
Pain immediate	0	0	0	0
Pain late	6	100	0	0
Gritty feeling	6	100	3	50
Lacrimation	6	100	2	33
Photophobia	6	100	1	16
Blepharospasm	6	100	0	0
Blurred vision	6	100	0	0
Headache	2	33	0	0

* May be asymptomatic but with conjunctival injection and/or corneal epithelial flecks.

Whereas the lids of the eyes contaminated with liquid mustard were so severely swollen (even as early as four hours after exposure) that the casualties were unable to open their eyes for days and had severe blepharospasm, the lids of the eyes exposed to vapor only were never more than moderately swollen and

without blepharospasm. It is believed, therefore, that severe swelling of the lids (except for that due solely to external lid burns) should be considered a sufficient criterion for evacuation.

TABLE 2

COMPARISON OF THE LID SIGNS IN SIX
CASUALTY AND SIX NONCASUALTY
MUSTARD-EXPOSED EYES

Lid Signs	Casualty		Non-casualty	
	No.	Per-cent	No.	Per-cent
Severe swelling (unable to open eyes)	6	100	0	0
Moderate swelling			3	50
Slight swelling			1	16
No swelling			2	33
Blepharospasm	6	100	0	0

Mucopurulent conjunctivitis developed in four of six eyes splashed with mustard, being very severe in one instance. This is in marked contrast to the findings in vapor-exposed but noncasualty cases.

TABLE 3

COMPARISON OF CONJUNCTIVAL DISCHARGE IN
SIX CASUALTY AND SIX NONCASUALTY
MUSTARD-EXPOSED EYES

Conjunctival Discharge	Casualty		Non-casualty	
	No.	Per-cent	No.	Per-cent
Lacrimation	6	100	3	50
Mucopurulent, severe	1	16	0	0
Mucopurulent, moderate	1	16	0	0
Mucopurulent, slight	2	33	1	16

The conjunctival changes observed in the splashed eyes were: severe congestion, thromboses of vessels, hemorrhages, necrotic patches with budding new vessels, and marbling. Similar, but much slighter, changes were found in the limbus.

Four of six vapor-exposed eyes showed conjunctival congestion. The other two eyes had epithelial flecks. It is felt, therefore, that epithelial flecks have about the

same diagnostic and prognostic significance as has conjunctival congestion. Except for congestion and epithelial flecks, the vapor-burned eyes appeared normal.

Four of six splashed eyes showed bandstaining, punctate staining, bedewing, and epithelial flecks of the corneas. The other two eyes would probably have shown the same changes, but the patients were too ill for slitlamp examination. Five of these eyes had hazy, gray (opaque), irregular, faceted corneal surfaces (orange-peel or peau d'orange).

TABLE 4

COMPARISON OF CONJUNCTIVAL SIGNS IN SIX CASUALTY AND SIX NONCASUALTY MUSTARD-EXPOSED EYES

Conjunctival Signs	Casualty		Non-casualty	
	No.	Per-cent	No.	Per-cent
Congestion	6	100	4*	66
Thromboses	6	100	0	0
Hemorrhages	4	66	0	0
Vessel variation in caliber	6	100	0	0
New vessels	5†	83	0	0
Necrotic patches	6	100	0	0
Marbling	6	100	0	0

* Two patients had only epithelial flecks.

† One patient died too early for new-vessel formation.

Five of six vapor-exposed eyes showed epithelial flecks (one patient was too ill with skin burns for slitlamp examination). There was punctate staining of the epithelial cells in two cases and epithelial bedewing in another.

Five of six splashed eyes had edema of the anterior part of the substantia propria (two patients were too ill for slitlamp examination, but one eye was examined histologically). Other stromal changes in this group were: complete edema, cellular infiltration, stratification, and fibrous scarring. One of these patients had definite corneal vascularization on the fortieth day.

The substantia propria of the vapor-burned eyes appeared normal.

TABLE 5

COMPARISON OF CORNEAL-SURFACE CHANGES IN SIX CASUALTY AND SIX NONCASUALTY MUSTARD-EXPOSED EYES

Corneal-Surface Signs	Casualty		Non-casualty	
	No.	Per-cent	No.	Per-cent
Epithelial flecks	4†	66	5††	83
Band staining	4	66	0	0
Punctate staining	4†	66	2	33
Bedewing	4	66	1	16
Hypoesthesia	6	100	0	0

† Two patients, too ill for slitlamp examination.

†† One patient, too ill for examination (slitlamp).

Only one eye showed edema of the endothelium; the endothelial cells stained with fluorescein; the aqueous appeared normal.

One patient died 28 hours after exposure to mustard droplets from pseudodiphtheric inflammation of the respiratory passages and bronchopneumonia with respiratory obstruction and cardiac failure. He was a senior officer, aged 47 years, standing over two chemical land mines containing 94 lbs. of mustard which unexpectedly detonated. He was drenched with liquid mustard. Although he felt fluid enter both eyes, he had no sensation of pain but did have an immediate, sandy or gritty foreign-body

TABLE 6

COMPARISON OF SUBSTANTIA-PROPIA CHANGES IN SIX CASUALTY AND SIX NONCASUALTY MUSTARD-EXPOSED EYES

Changes in Substantia Propria	Casualty		Non-casualty	
	No.	Per-cent	No.	Per-cent
Anterior edema	5*	83	0	0
Complete edema	2*	33	0	0
Cell infiltration	4*	66	0	0
Stratification	1*	16	0	0
Fibrous scarring	4*	66	0	0
Superficial vascularization	1*	16	0	0

* Two patients too ill for slitlamp examination.

feeling, which persisted thereafter. Irrigation with normal saline was started at the end of about three minutes but was very brief.

The patient complained of blurred vision and of severe lacrimation, photo-

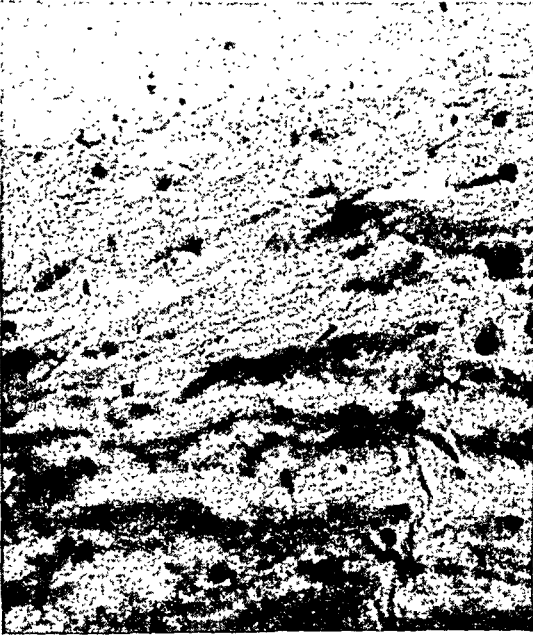


Fig. 6 (Uhde). Group III: Photomicrograph of a tangential section of the cornea of a mustard-splashed eye, showing destruction of epithelium, wrinkling of Bowman's membrane, swelling of the lamellae, and infiltration of leukocytes ($\times 200$)

phobia, blepharospasm, and, of a gritty, foreign-body sensation. He was especially troubled about his blurred vision: he was unable to identify his surroundings, his friends, physicians, and nurses.

Upon examination, five hours after the accident, the upper and lower lids were so edematous and congested that they could be separated only about 3 mm. The tarsal and bulbar conjunctivas were severely chemotic and congested with numerous subconjunctival and conjunctival hemorrhages. Many of the bulbar conjunctival vessels were constricted and thrombosed while others were engorged, including those of the limbus. The ciliary

vessels were congested. The corneal surfaces appeared hazy, gray (opaque), with irregular faceted surfaces (orange-peel). A horizontal band of deep-green staining with fluorescein was observed, limited to that area of each cornea normally exposed in the interpalpebral space. The remaining corneal surfaces, normally protected by the lids, did not stain but appeared rough and opaque.

Twenty-four hours after the accident, or five hours before death, the whole corneal surfaces stained except for very small areas contiguous with the upper limbus. Even those areas, however, were rough and hazy in appearance. Corneal sensation was diminished.

At necropsy, the right eye was removed for histologic examination. The eye was fixed in 10-percent formol-saline, washed in running water for 24 hours, and placed in Zenker's solution. After dehydration and embedding in paraffin, tangential sections were cut and stained with Ehrlich's hematoxylin-eosin and Van Gieson's stains.

Examination of the histologic sections showed complete destruction of the corneal epithelium (fig. 6). Bowman's membrane was wrinkled, swollen, and stained very poorly. The spaces between the lamellae were distended with fluid and leukocytes. Most of the endothelial cells were detached from Descemet's membrane.

PIGMENTATION

It was observed in a few Negroes treated at Edgewood Arsenal that brown pigment invaded the superficial corneal cells after damage from mustard. This was a common observation in mustard-burned rabbits' eyes as first reported by Ida Mann.

PROTECTION

Gas masks gave complete protection to the eyes and lungs.

Eyeshields protected the eyes against drops but were not relied upon to give protection against vapor (group II: moderate case report), although in some instances (table 7) the eyeshields appeared to give some protection even against vapor. That the ordinary antigas eyeshields

EVACUATION OF EYE CASUALTIES

Since eyeshields cannot be depended upon to give protection against vapor, gas masks were worn by those attending contaminated cases. During this war, after a large transportation accident, over 100 vapor eye casualties resulted from ex-

TABLE 7
PROTECTION AFFORDED BY EYESHIELDS AGAINST MUSTARD DROPLETS

Patient No.	Duration of Exposure minutes	Onset of Symptoms hours	Eyeshields		Photophobia	Lacrima-tion	Blepharo-spasm	Head-ache
			Not Removed	Removed				
1	40	7		×	×	×	—	—
2	40	12		×	×	×	—	—
3	30	13	Wore spectacles		×	×	×	×
4	30	8		×	×	×	×	—
5	30	—		×	—	—	—	—
6	20	17		×	×	×	—	—
7	30	10		×	×	×	—	—
8	45	—	×		—	—	—	×
9	60	—	×		—	—	—	—
10	60	—	×		—	—	—	—
11	60	—	×		—	—	—	—
12	45	16		×	—	×	—	—
13	30	5		×	×	×	×	—
14	20	9		×	×	×	×	—
15	20	9		×	×	×	×	—
16	30	—	×		—	—	—	×
17	30	9		×	×	×	×	—
18	45	18		×	×	×	—	—
19	120	4		×	—	×	—	—
20	30	6½		×	×	×	×	—

× = Yes — = No.

gave protection against mustard droplets was shown by the following training accident. Two bombs, which the instructor thought contained simulated mustard but actually contained mustard, were detonated 15 to 20 yards upwind of a gun crew in a gun pit. All the soldiers, except one wearing ordinary spectacles, wore eyeshields. Many of the soldiers stated that the eyeshields were splashed. Not one of the soldiers wearing eyeshields developed symptoms or signs of mustard-gas burns (patients 5, 16 and 8 to 11 incl). The soldier wearing spectacles had the most severe symptoms and lesions with bedewing and edema extending into the substantia propria.

posure to mustard-contaminated patients because gas masks were not worn.

GAS-MASK SPECTACLES

The ordinary spectacle frame cannot be worn in conjunction with the ordinary gas mask. The overall width of the spectacle frame is too great. The gas mask rests on the frame and presses the nasal bridgepiece heavily onto the nose. Moreover, there is leakage of gas around the temple-pieces.

Early in World War II an attempt was made to overcome these difficulties by projecting the temple-pieces directly backward off the metal rims of the lenses, thereby reducing the overall width of the

spectacle frame and, at the same time, permitting the temple-piece to fit more closely to the skin of the face. Such a spectacle was unsuccessful, largely because the frame required accurate adjustment initially and frequent readjustment in the field, which involved a tremendous amount of work and was never done. If the frame is not adjusted properly, leakage of gas invariably occurs around the temple-pieces, and the results in battle could be quite disastrous. Nevertheless, a very successful and ingenious means was finally found for the insertion of a spectacle lens directly behind the gas-mask lens.

TRAINING

Although the vast majority of ophthalmic chemical casualties were vapor burns, and as physicians we are very much interested in this important fact, I cannot concur with the belief of some observers that splash injuries of the eye were over-emphasized in training. It is true the eye is a small target, but it is also true that the soldier is unable to do much about vapor burns, whereas his recovery from a

liquid contamination depends upon whether he himself irrigates his eye or instills an ointment, and his action at that particular moment will usually reflect upon his training. Finally, although a soldier has eyeshields, if he doesn't wear them and he is blinded from a splash, the Service is nonetheless responsible.

CONCLUSIONS

Mustard vapor was responsible for the great majority of chemical eye casualties seen by ophthalmologists during World War II, as shown by the fact that of 1,097 eye, ear, nose, and throat burns treated at Edgewood Arsenal over a period of 17 months, mustard vapor accounted for 1,008, and of this number 790 were eye burns.

A classification of mustard eye burns with case illustrations is presented. This classification proved of practical value in the treatment and prognosis of casualties in fixed installations and may be useful to medical officers in forward echelons.

The clinicopathologic findings in casualty and noncasualty patients are discussed.

EARLY OCULAR MANIFESTATIONS IN THE LAURENCE-MOON-BIEDL SYNDROME*

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The Laurence-Moon-Biedl syndrome, consisting of obesity, hypogenitalism, mental retardation, polydactyly, and retinal degeneration, is occasionally seen by the ophthalmologist when a child is presented complaining of loss of sight which is not helped by correction of the refractive error.

Laurence and Moon⁸ in 1866 described four cases of retinitis pigmentosa with developmental disturbances occurring in the same family. These children all had night blindness and no apparent constriction of visual fields. Höring,⁶ Stör,¹⁸ and DeWecker²¹ at about the same time noticed similar patients with polydactyly. Fröhlich⁵ in 1901 described the type of obesity, bearing his name, which is also found in these cases. Biedl² in 1922 correlated these symptoms; adding mental deficiency, and presented two additional cases.

Obesity of the Fröhlich (pituitary) type shows a fat distribution similar to that in the female. Hypogenitalism is not invariably constant. Mental retardation may be slightly evident in the early stages but usually increases along with the progression of the other symptoms. Polydactyly is of the postaxial type. There is never more than one extra digit. Syndactyly is also found.¹³ There appear to be two types of retinal dystrophy (a term implying degeneration of abiotrophic nature). One shows a resemblance to typical retinitis pigmentosa, the other has the appearance of cerebromacular degeneration. Nystagmus and strabismus have oc-

asionally been mentioned in reports of these cases. One or more of the symptoms of the syndrome may be absent.¹⁹

Of the symptoms comprising the syndrome, polydactyly is an hereditary mesoblastic fault or maldevelopment; the remainder are ectoblastic of probable abiotrophic nature, as there is progressive degeneration of previously fully developed and functioning tissue. The seat of the neuro-ectodermal disturbances is in the prosencephalon (forebrain) from which the optic vesicle develops to form the nervous and pigmentary layers of the retina. The prosencephalon consists of the telencephalon (the cerebral hemispheres) and the diencephalon (the thalamic region). These produce the optic hypothalamus of the former mammillary hypothalamus of the latter. The optic hypothalamus is apparently the location for the cerebral disturbance producing the syndrome. It consists of the lamina terminalis (anterior wall of the third ventricle), the optic chiasm and optic tracts and the tuber cinereum, infundibulum, and hypophysis. This anatomic association indicates the close relationship between the retinal and cerebral structures and suggests the reason for the combination of symptoms producing the syndrome as the result of regional degeneration. Whether this failure of viability is primarily ectoblastic or mesoblastic (a result of nutritional decline) is of speculative interest as pathologic examination of the few autopsies reported has, so far, failed to demonstrate substantial evidence on behalf of either primordial tissue. This falls in line with the discussion as to the primary causative agent, or the primary

* Presented at the 81st annual meeting of the American Ophthalmological Society at Hot Springs, Virginia, November, 1945.

tissue, involved in the degeneration found in retinitis pigmentosa.

The subjective symptom of the Laurence-Moon-Biedl syndrome is loss of central vision not correctable with glasses. There is an early reduction of central vision; later peripheral constriction. Early visual-field studies show an expanding central scotoma; peripheral concentric constriction gradually develops. The para- and pericentral fields remain until last.

Ophthalmoscopic examination may reveal nothing abnormal at first. White or pigmented macular spots or stippling appear usually in the early stage. Later the periphery of the retina begins to show atrophy, and finally pigment appears. With the peripheral changes, the retinal blood vessels become attenuated, and pallor is seen at the disc.

The onset of the Laurence-Moon-Biedl syndrome is in early life and may be detected before the school age. Prognosis is grave, for there is gradual reduction of mentality and loss of sight. Associated conditions have previously been mentioned as the other symptoms of the syndrome.

Family history is generally negative, although some authors report frequent alcoholism and mental instability in the ancestry. Consanguinity is variously noted as being between 14 percent (first cousins) and 23 percent (first and second cousins). The condition is recessive and apparently consists of a combination of mesoblastic skeletal deformity and epiblastic retinal and cerebral dystrophy, probably due to a mutation of two genes in the same chromosome.

CASE REPORTS

Case 1. F. R., aged 20 years, is the third of three children. An older brother and sister are normal. Her weight was 148 pounds and height 65 inches. The

sixth finger on the right hand was removed nine years ago. Menstruation has been regular since the age of 15. Diabetes insipidus is present. Mental retardation is not evident to any great extent.

This young lady came for an eye examination because of failing vision. She thought her sight began to disturb her at about 10 years of age. At the time of the examination, vision in the right eye was 20/200, in the left eye 20/200. Refractive correction did not improve vision. A small (5-degree), absolute central scotoma was found in both visual fields. Peripheral fields were normal. Ophthalmoscopic examination showed some retinal atrophy (fig. 1), with pallor of the discs and slight attenuation of the retinal vessels. This fundus picture was believed to be an early stage in the course of pigmentary degeneration of the retina, the prepigmentary stage. With polydactyly and these eye findings, the impression is that of an incomplete Laurence-Moon-Biedl syndrome.

Case 2. M. J. D., aged 12 years. There is one older child who is well. Her weight was 138 pounds and height 59 inches. Menstruation has not yet appeared. The child is obese. She was very thin at birth but became obese from six weeks on. She had thyroid and pituitary treatment for two years without benefit. She has an enormous appetite. Reducing diet was prescribed but not followed. There is no history of polyuria or polydipsia. Urine examination was negative. Basal metabolic rate was minus-8 percent. Kahn test was negative. A sixth finger on the right hand was removed. Skull plates were negative, ossification corresponding to age. On the Stanford-Binet test, a mental age of seven years, three months and an I.Q. of 60 were obtained. This classifies the child as definitely feeble-minded and in the group of "moron." The child is in the

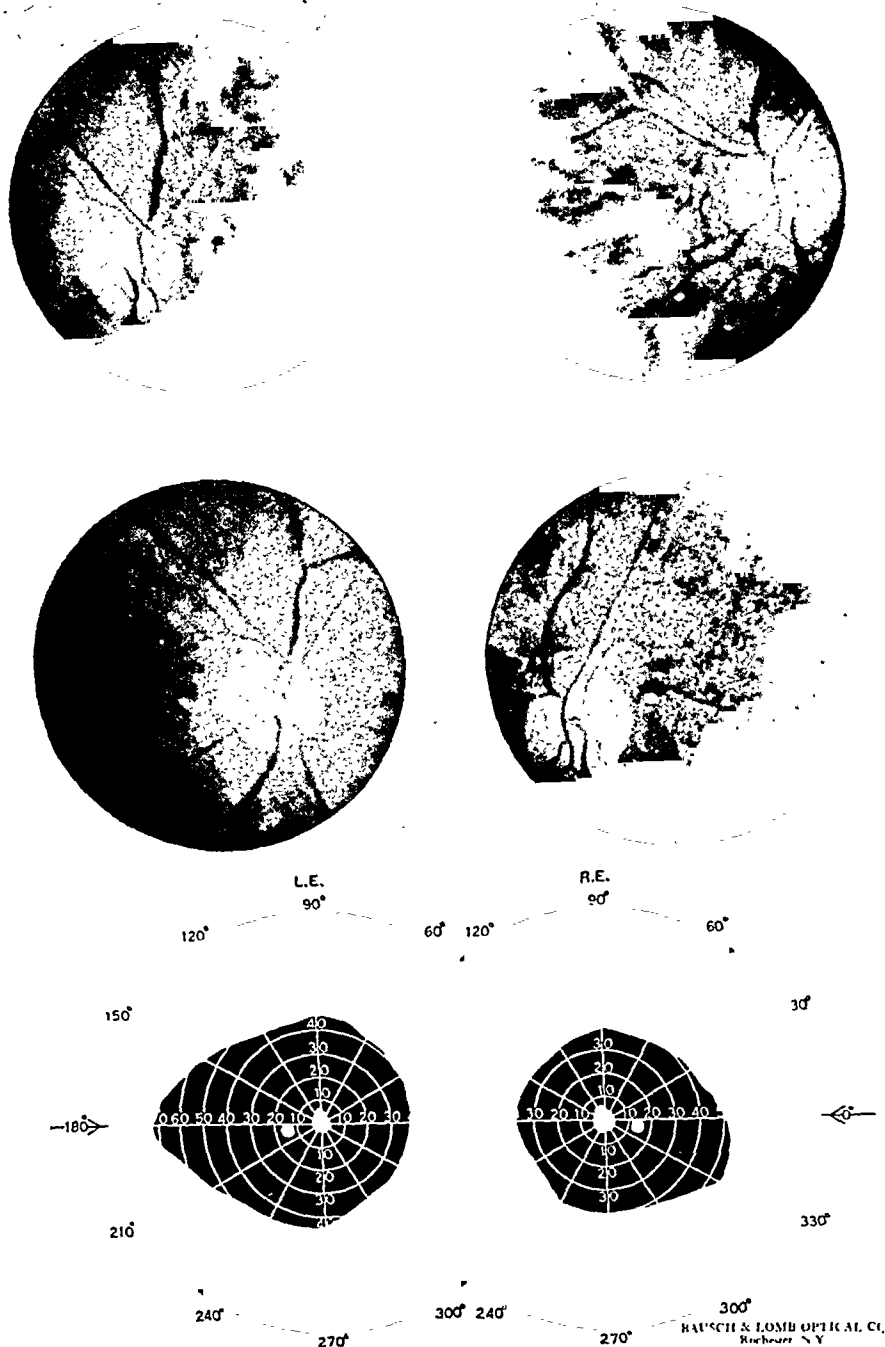


Fig. 1 (Lyle). Early stage of Laurence-Moon-Biedl syndrome. Retinal atrophy with absolute central scotomas.

fifth grade of school but will have to repeat. The mother thinks she has good memorizing ability but poor reasoning.

The child was brought for eye examination because of poor vision which, ap-

parently, glasses could not correct. Mental retardation was acknowledged by the mother, who thought that it was due to the poor sight. At the time of the examination, vision in the right eye was 20/200,

in the left eye 20/200. Refractive correction with a compound myopic astigmatic lens for each eye improved vision to 20/100 in the right eye and 20/70 in the left. A small (5-degree), absolute central scotoma was found in both visual fields. Peripheral fields showed some temporal constriction. Ophthalmoscopic ex-

dactly, and retinal degeneration, a diagnosis of Laurence-Moon-Biedl syndrome was made.

Case 3, A. P., a woman aged 36 years, was examined 18 years ago because of poor vision. At that time she had stopped going to school where she was not pro-

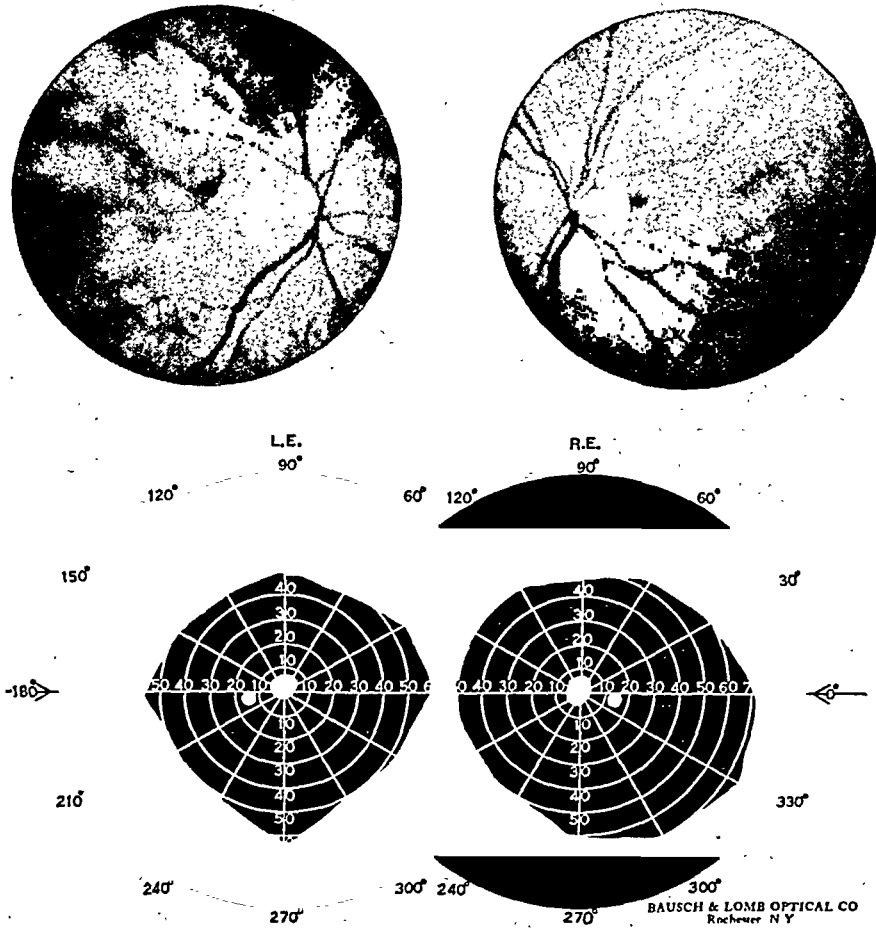


Fig. 2 (Lyle). Early stage of Laurence-Moon-Biedl syndrome. Retinal atrophy with absolute central scotomās.

amination revealed some retinal atrophy (fig. 2), with pallor of the discs and slight attenuation of the retinal vessels. The atrophy is somewhat more pronounced than in the preceding case (see figure 1). Pigmentation of the periphery of the retina has not yet appeared.

With the presence of obesity, possible hypogonadism, mental retardation, poly-

gressing and had gone to work, but her vision was so bad she could not hold her job. Her low intelligence, which was quite evident upon examination, was not at first accepted by the mother, who blamed reduced vision entirely for the girl's lack of progress.

The exact weight and height were not taken. However, the patient was short in

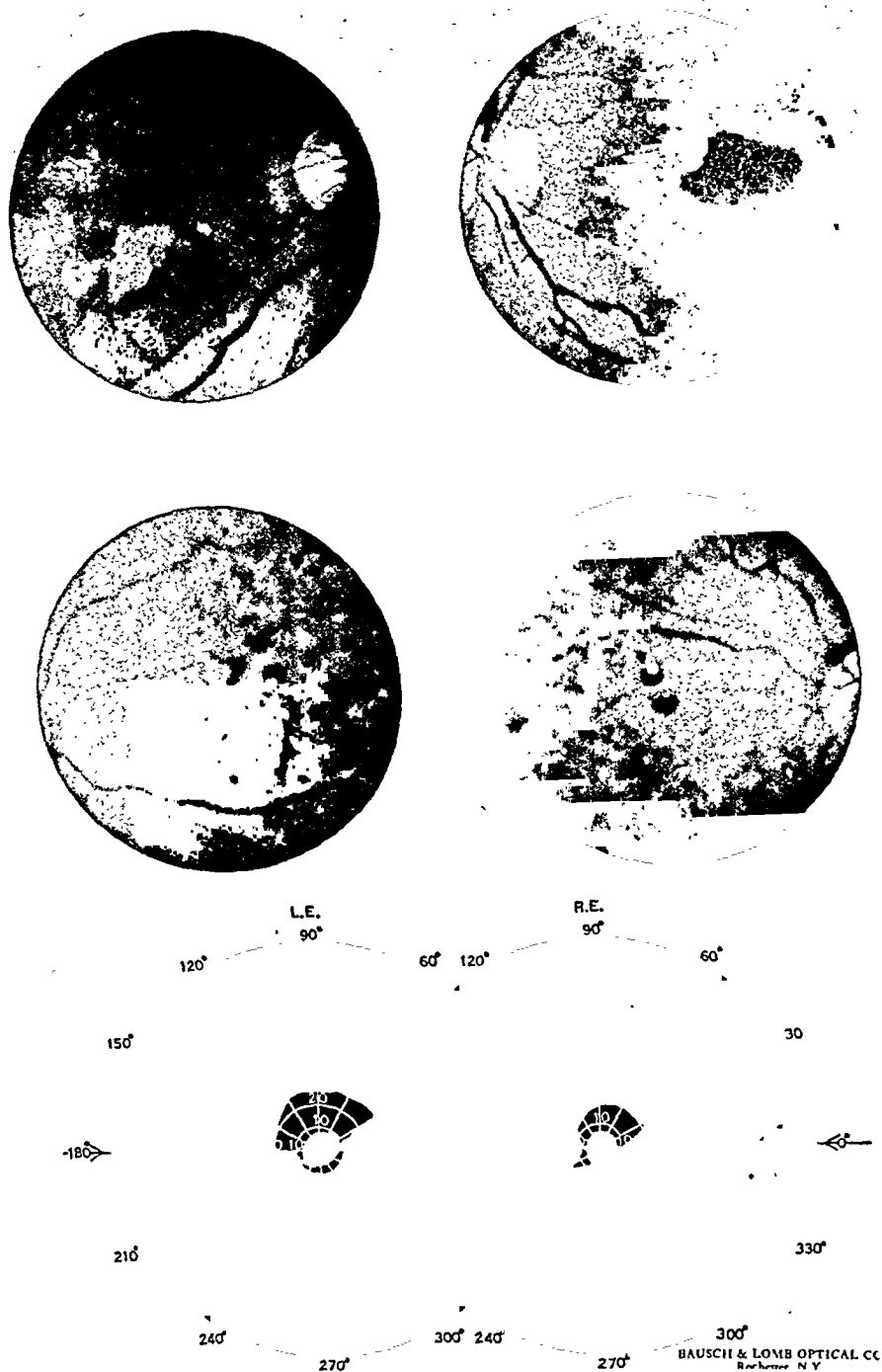


Fig. 3 (Lyle). Advanced stage of Laurence-Moon-Biedl syndrome. Plaques of retinal degeneration in macular area. Peripheral atrophy with pigmentation. Constricted visual fields with central scotomas.

height and quite obese. She had never menstruated. The basal metabolic rate was minus-28 percent. Urine examination was negative. The blood Wassermann test

was negative. The skull plates were negative. A sixth finger on the left hand had been removed. An I.Q. of less than 60 was obtained.

When first seen, vision in the right eye was 10/200, in the left eye 8/200. There was a small, round, absolute central scotoma of about 5 degrees in each eye. Peripheral fields were normal. A myopic correction improved vision in each eye to

peared, mental retardation was possibly more marked, and retinal degeneration with loss of vision had greatly increased.

At the last examination, the right eye had only light perception, the left 1/200. Ophthalmoscopic examination showed

TABLE 1
SYMPTOMS OF THOSE CONDITIONS FROM WHICH LAURENCE-MOON-BIEDL SYNDROME SHOULD BE DIFFERENTIATED

	Heredo-macular Degeneration	Leber's Hereditary Optic Atrophy	Cerebro-macular Degeneration	Laurence-Moon-Biedl Syndrome	Retinitis Pigmentosa
Onset	Periods of physiologic change	Indefinite, second decade	Childhood, second dentition	Early childhood	Puberty or early adult
Inheritance	Recessive—irregular Dominant	Recessive and sex-linked in males through females	Recessive	Recessive	Recessive, Dominant, Sex-linked
Sex	About equal	Males predominate	About equal	About equal	Males predominate
Chief symptoms	Diminution of vision	Diminution of vision	Diminution of vision	Diminution of vision	Night blind constricted v.
Central visual fields	Scotoma	Scotoma	Scotoma	Scotoma	Normal until late
Peripheral visual fields	Normal	Constriction slight & late	Constriction to blindness	Constriction to blindness	Ring scotoma expanding
Central fundus	White & pigment stippling	Nothing characteristic	White & pigment stippling	White & pigment stippling	Pigment stippling
Peripheral fundus	Normal	Nothing characteristic Atrophy	Marked atrophy Pigment late	Atrophy Pigment late	Early pigment and atrophy
Peripheral fundus	Normal	Nothing characteristic Atrophy	Marked atrophy Pigment late	Atrophy Pigment late	Early pigment and atrophy
Papilla	Normal or pale	Pallor, more temporal*	Gradual pallor to atrophy	Gradual pallor to atrophy	Gradual pallor
Retinal vessels	Normal	No changes constant	Gradual attenuation	Gradual attenuation	Gradual attenuation
Termination	Central vision impaired or lost	May recover some vision	Blindness & early death	Blindness & dementia	Blindness late
Affiliated conditions	Nothing constant	None	Marked cerebral degeneration	Obesity Hypogenitalism Mental reduction Polydactyly	Deafness in recessive type

* Early normal discs or papilledema; later atrophy of papillo-macular bundle; may resemble either primary or secondary atrophy.

20/200. Ophthalmoscopic examination revealed some white macular and paramacular stippling, with some pallor of the discs and slight attenuation of the retinal vessels.

When last examined, 12 years after the first examination, all of the symptoms had increased. The obesity was more evident, the weight was 165 pounds, and the height 62 inches. Menstruation had never ap-

large plaques of central retinal degeneration, atrophic discs, and attenuated retinal vessels (fig. 3). Peripheral retinal degeneration was marked with pigment deposits. Visual fields showed nearly a meeting of the greatly constricted peripheral fields with the original, central scotomata.

With obesity, hypogenitalism, mental retardation, polydactyly, and retinal degeneration this patient has been diagnosed

as having a Laurence-Moon-Biedl syndrome.

Laurence-Moon-Biedl syndrome must be differentiated from Leber's hereditary optic atrophy, which it resembles in its early stage, and from typical retinitis pigmentosa, which it resembles in its advanced stage. It must be differentiated from the various types of cerebro-macular degeneration which may have very similar subjective symptoms and fundus appearance. However, cerebral degeneration is much more manifest in cerebro-macular degenerative conditions than it is in the Laurence-Moon-Biedl syndrome (table 1).

CONCLUSION

The Laurence-Moon-Biedl syndrome shows, at first, nonpigmented retinal degeneration with loss of central vision, with a small, central scotoma. The macular area may show some white or pig-

mented stippling. The retinal vessels and disc appear normal.

As the retinal degeneration proceeds, pigmentation appears in the periphery, the retinal vessels become more and more attenuated, and the disc increases in pallor. The macular area shows increased degenerative changes, with or without pigmentation.

The resemblance to Leber's hereditary optic atrophy and the various types of cerebro-macular degeneration with central scotomas, loss of vision, and cerebral symptoms is remarkable in the early stages of both conditions. In later stages, the pigmentary degeneration may be confused with typical retinitis (retinosis) pigmentosa by the casual observer who fails to take a detailed history of the case and to make a complete examination in order to reveal the other components of the syndrome.

904 Carew Tower (2)..

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PLASTIC EYE IMPLANT*

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The patient's appearance after enucleation has long been a problem for the eye surgeon. Only patients with deep-set eyes and narrow fissures actually wear a prosthesis without "stare" or a sunken-in appearance. The socket cannot be filled out by a loose fitting "reform," "stump," or other type of shell eye, because of constant shrinkage of other orbital tissues as well as the ocular conjunctiva. Sub-

capsule. The shell eye uses the entire area, wall to wall, and there is no place for the prosthesis to move. Implants within the muscle cone or inside the scleral shell, if fitted with a "stump" shell, give good movement. However, these implants also "stare" on lateral gaze and actually do not move very extensively.

With the advent of the new plastic reform eye, I thought that it might be

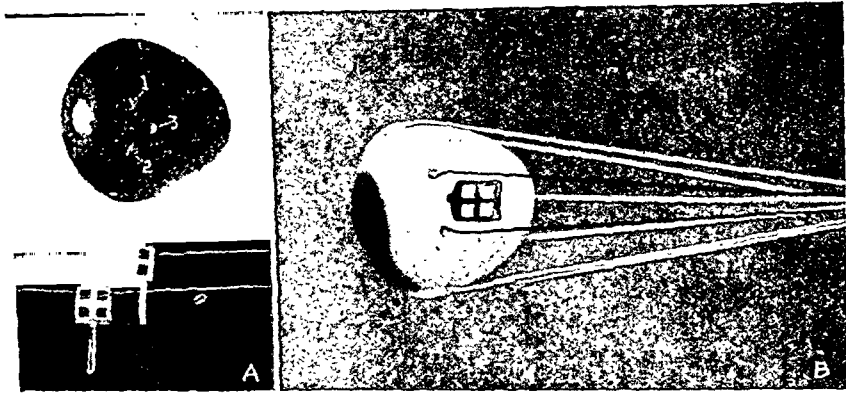


Fig. 1 (Ruedemann). Plastic implant showing position of holes for sutures and paddles.

sequently, smaller shells must be fitted when actually the area to be filled is larger. Attempts to fill out the socket by plastic addition above will eventually result in a pushing out below with loss of the lower cul-de-sac from pressure of the upper lid and weight of the prosthesis.

Normally the orbit is completely occupied, the eyeball using one fifth of this total area. Therefore, loss of volume alone is sufficient to produce an enophthalmic appearance unless this volume is replaced. "Stare" is present only when the eyeball does not rotate within Tenon's

possible to use the material as a full eye implant. Mr. Fritz Jardon, then of the Mono Plastic Eye Company, now with the American Optical Company, made up, and I used, various sized and shaped eyes. Most of the early eyes were too small and wrongly shaped. Figure 1 shows the present type. Various types of suture material were tried, mostly unsuccessfully. The present method was developed by trial and error plus much effort. Failures were mostly mechanical, and until recently the problem seemed almost hopeless. Mr. Valentine Seitz, deceased, chief of the Electro-mechanical Engineering Division, aided materially in the designing of the eye and the method of attaching the muscles.

Tantalum wire (.005) was the only

*From the Cleveland Clinic. Read at the eighty-first annual meeting of the American Ophthalmological Society, at Hot Spring, Virginia, November, 1945.

suture material to hold up indefinitely (fig. 2). The wire is inert and does not cause tissue reaction. However, it is diffi-

cessfully placed, and none have been extruded with the present method of implantation. Only minor mechanical

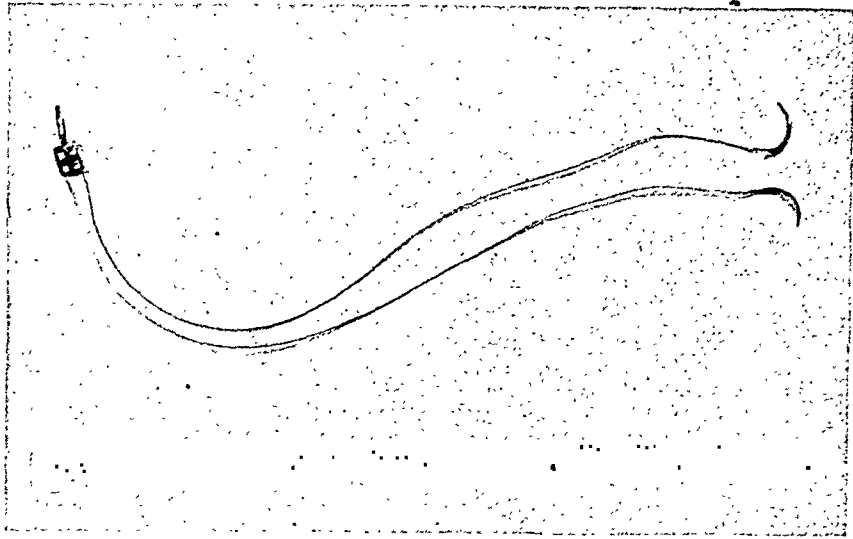


Fig. 2 (Ruedemann). Double-armed tantalum suture.

cult to handle at first, breaks easily, and requires patience and care in handling. Granulation tissue does not tend to form except in cases of mechanical or surgical failure. Globes attached to muscles only with wire will stay in, but so much muscle is required in the suturing to maintain the attachment that the eye is set too deeply in the socket.

I believed that a firmer and more permanent attachment could be obtained by the use of an intermediate muscle plate of tantalum (fig. 3), the plate to be attached to the muscle and then to the plastic globe. Quite a number of different styles of plates were tried, and the present issue seems to be the most satisfactory to use and attach. This plate (fig. 2) is made of tantalum and sutured as in figure 3. It forms a solid unison with the muscle, and, with the paddle end placed in hole 3 and the two wire sutures passing through holes 1 and 2, the implant is firmly fixed (fig. 1).

To date over 100 eyes have been suc-

cessfully placed, and none have been extruded with the present method of implantation. Only minor mechanical

TECHNIQUE OF IMPLANTATION

Matching the good eye for color and outstanding iris markings may be accomplished in several ways. Color photography accurately reproduces markings

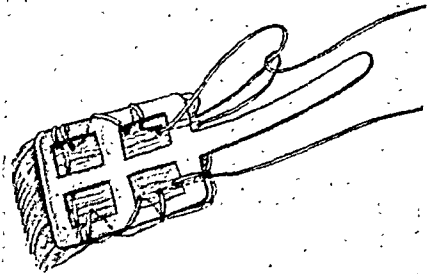


Fig. 3 (Ruedemann). Tantalum paddle attached to under side of muscle.

but not color. A matching set which is now being made available is likely to be more satisfactory. Except when executed

by experienced artists, such as our Miss Boyle, the eye may be more artistic than actual, and the color is not good. Eyes must be matched in daylight for accuracy in color.

Corneal size varies and must be measured. Most corneas measure 11 to 11.5 mm. in the horizontal meridian, and unless the vertical is much greater, the cornea may be round. Usually the 180-degree meridian is 0.5 mm. longer. The pupil also varies in size and must be carefully measured. The tendency is to make it too small, although it is rarely less than 3.5 mm. and averages 4.5 mm. The pupil is measured in daylight, not when facing sunlight or too bright a reflecting wall. The pupil may be off center, being closer to the nose, and can be duplicated as can any other outstanding characteristic. Mr. Jardon has been efficient in duplicating eye markings.

Former difficulty with color fading has been largely overcome. Occasionally an eye will fade because of the dyes or because the patient's body fluids work

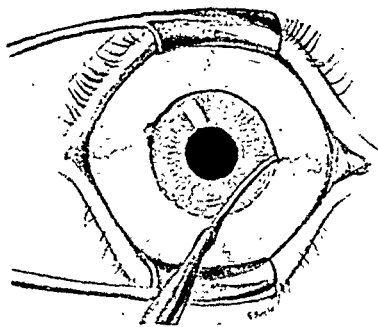


Fig. 4 (Ruedemann). Circumcorneal incision.

through the slightly porous plastic material. To date, this has been a rare complication. Etching of the clear cornea is not a complication, nor is there a color change in the material itself.

A number of scleral colors should also be matched, for which there is now

a matching set. Individual scleral-vessel markings should be noted. Attention to these details results in the best appearance after operation.

It now requires 48 to 72 hours to process an eye. This time will be cut to 24 hours when the code method now being worked out is finally established.

Anesthesia. I have used both local and general anesthesia. Local anesthesia, accomplished by injecting 2-percent novo-

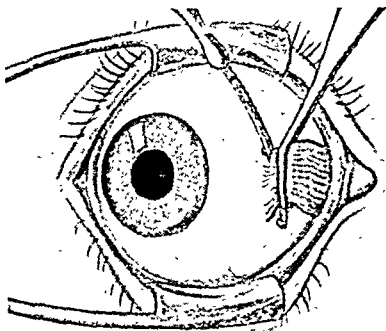


Fig. 5 (Ruedemann). Cutting of muscle with canaliculus knife.

caine deeply into the orbit in three places—inferiorly laterally, superiorly and inferiorly mesially—expedites the operation but is distressing for the patient. Sodium pentothal or avertin, according to the patient's age, is an easier anesthetic for the patient to bear. The bleeding is greater with general anesthesia than with local, and therefore there is more local reaction.

Operation. The operation requires about one hour, but varies with the speed of the operator. The procedure is simple enucleation with circumcorneal incision with scissors or canaliculus knife (fig. 4). *Dissect very little conjunctiva.* Button-hole Tenon's capsule alongside the superior rectus muscle, which should be picked up with the hook but not dissected too freely. Place muscle clamp and cut muscle with canaliculus knife (fig. 5). Fasten

muscle plate to underside of muscle with tantalum wire (fig. 3). This is mechanically difficult because the wire hardens and will break if kinked. To prevent kink-

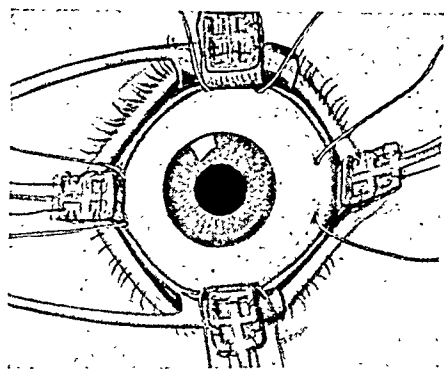


Fig. 6 (Ruedemann). Paddles attached to the 4 rectus muscles.

ing it must be rolled on itself or kept straight. The sutures are 12 inches long. The Johnson and Johnson Company have promised a new tantalum-wire material, to which the needles will be swedged, and this wire will not break so easily. These two features would eliminate a major difficulty in the surgery; that is, breakage

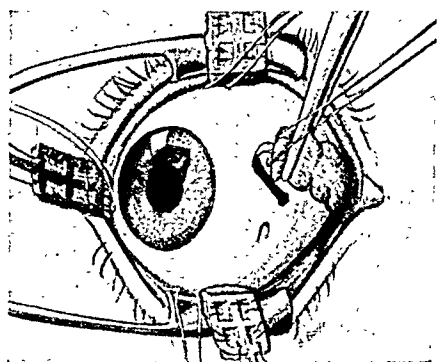


Fig. 7 (Ruedemann). Paddle being inserted into plastic eye.

of the wire and tearing of tissues by the needle.

The best order in which to remove the muscles is as follows: Superior rectus, internal rectus, inferior rectus, and external rectus. The obliques are not attached unless the eye is prominent, then

they aid in keeping the eye forward. To date, I have attached the latter directly to the globe without the muscle plate. Most eyes have excellent movement without attachment of the obliques, and fastening these muscles is difficult. The loose ends of the double-armed sutures are held out of the way with hemostats. Care should be taken not to kink the wire.

After bleeding has been completely controlled, the implant is placed in the socket (fig. 6). Linen-thread loops have previously been placed in the attachment holes to aid in manipulating the implant (fig. 1). For each muscle three holes are placed at a prescribed distance from the limbus: internal rectus, 5 mm.; inferior rectus, 6 mm.; external rectus, 7 mm.;

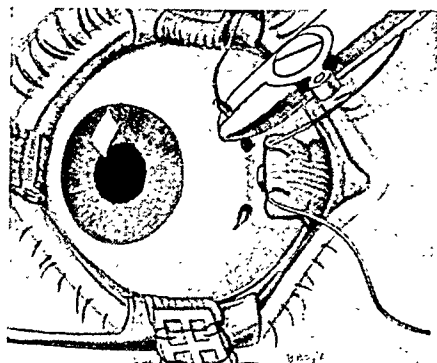


Fig. 8 (Ruedemann). Method of attaching sutures.

superior rectus, 8 mm. I believe this may need to be revised, and we are now obtaining our own average distances.

The hole for the paddle tip is placed directly behind and between the attachment holes and is directed posteriorly. This allows the tip to be bent over and fixed. The superior rectus muscle with plate attached is picked up with a straight hemostat, and the tip is bent. The globe is depressed and the tip inserted into globe hole 3 (fig. 7). The wires are then passed through holes 1 and 2 and tied (fig. 8). Care must be taken not to break the wires, which should be held not too far away

from the knot in tying (fig. 9). The ends are twisted together and cut short and turned into hole 1 or 2 with a fine-tipped hemostat or watchmaker forceps. This should be carefully done, because a tip end penetrating the tissues becomes a sore point.

The internal, inferior, and external rectus muscles are sutured in order. Care in suturing and traction on muscles will prevent tearing of muscles. When obliques are used, they are fastened first by a weaving suture and then attached directly to the globe. A single interrupted suture through both the lateral and mesial conjunctiva covers the internal and external muscle and closes the conjunctiva (fig. 10).

When the patient has been operated upon previously for enucleation, the socket may again be opened. The conjunctiva is to be opened with a horizontal incision made with scissors. This cut must

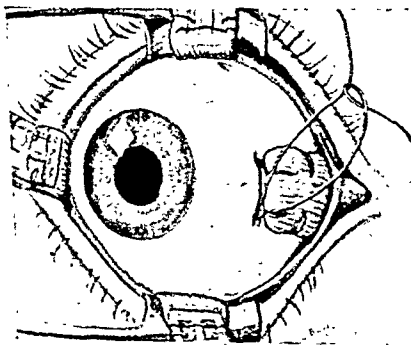


Fig. 9 (Ruedemann). Tying of stitch.

be 10 mm. long. The conjunctiva is then dissected free all around, for 5 to 10 mm. Tenon's capsule is opened and split tulip-fashion for the four rectus-muscle slips. The posterior orbit is next opened to make room for the implant. A suture through each muscle slip aids in attaching the muscle plate. Care in placing this plate prevents subsequent squint. The conjunctiva is closed as in the previous procedure.

The implants may be varied in size and shape and can be made available for any type of restoration. I have used them in badly restored sockets with surprising results as to appearance and movement.

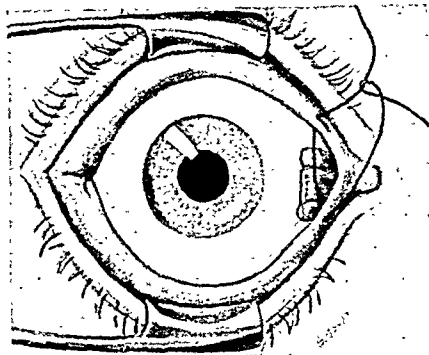


Fig. 10 (Ruedemann). Suturing of conjunctiva.

Very little attachment tissue is necessary, and by use of plates the eyes are retained in the socket. The ocular conjunctiva is not essential to the implant.

Dressing. A gauze pack, saturated with 5-percent sulfathiazole ointment, is placed under the lids. A pressure dressing is not desirable. Only loose-fitting gauze with an adhesive cover is necessary. The dressings are changed on the fourth or fifth day. The patient may be up in 24 hours and requires only four or five days' hospitalization. The reaction in most instances is slight.

Complications. Infection has not been a complication in any of our 100 operations. When the eye had to be replaced because of dyes fading, muscles becoming loose, or faulty insertion, the tissue from the socket around the implant was found to be lined with a smooth endothelial-like tissue without inflammatory reaction. There has been no postorbital granulation tissue and surprisingly little tissue reaction.

Color changes in the iris are due to body fluids and the dyes themselves. Any



Fig. 11 (Ruedemann). Postoperative patients.

severe reaction to the plastic has not been seen but could occur. Any reaction in the orbital tissue will quiet down. Deep-heat diathermy is contraindicated, for this would change the color of the plastic and the dyes.

Broken wires or muscles pulling loose may be reattached when the eye quiets down. The procedure is difficult, and sodium pentothal or other general anesthesia should be used. Hospitalization is not required. Slight bleeding or discomfort later is usually due to improper covering of the wire ends.

Partial ptosis may result from the eye

being set too deeply or from previous partial ptosis. I measure all globes with Hertel's exophthalmometer, and if beyond 20 mm. I attach the obliques. Discharge is not a complication except with incomplete covering of plates and wire ends.

SUMMARY

Implantation of a plastic eye is time-consuming, painstaking, and difficult. The end results in the appearance of the patient and in his psychologic response justify the effort (fig. 11).

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(6).*

THE EYE EXAMINATION IN THE DIFFERENTIAL DIAGNOSIS OF THE DISORIENTED PATIENT*

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The diagnostic problems offered by the disoriented patient are most frequently encountered in the receiving wards of the larger hospitals. By the expression "disoriented," or "out of contact," we refer to coma, delirium, apathy, or to other psychotic states which render the patient unable to give an adequate history of his condition, or to coöperate voluntarily in the physical examination. The fortunes of war enabled the author to observe some 15 such patients each month in the psychiatric ward of the Veterans' Administration Hospital at Hines, Illinois. Some of these patients were dependent upon the ophthalmologist's findings for a diagnosis; others depended equally on the eye examinations for the elimination of various differential diagnostic possibilities.

Here is a typical sampling of psychotic patients admitted to the psychiatric ward (which composes 20 percent of the beds on the Neuropsychiatric Service).

TABLE 1

ADMISSIONS (NOVEMBER 25, 1944 TO FEBRUARY 25, 1945)

Direct admissions to psychiatric ward	67
Patients, disoriented, directly admitted	40
Percentage, disoriented, directly admitted	60

Many cases of the types listed below were observed on the other divisions of the Neuropsychiatric Service.

In an over-all sampling of admissions to the entire Hospital, it would be found

* From the Veterans' Administration Hospital. Presented, in part, before the Chicago Ophthalmological Society, Chicago, Illinois, December 17, 1945. Published with permission of the Medical Director, Veterans' Administration, who assumed no responsibility for the opinions expressed or conclusions drawn by the author.

that the traumas, brain tumors, and cerebro-vascular accidents are more frequent than is indicated in the foregoing data from the psychiatric ward.^{10, 17, 19}

From these patients, a number have been selected to demonstrate the various disease groupings in which eye findings have been noted. The question of the importance of these findings relative to the

TABLE 2

DISORIENTED PATIENTS ADMITTED (November 25, 1944 to February 25, 1945)

Type of Case	No.	Total
Toxic (exogenous)		13
Alcohol	(12)	
Morphine	(1)	
Toxic (endogenous)		2
Uremia	(1)	
Hyperpyrexia	(1)	
Cerebro-vascular		4
Syphilis (central nervous system)		2
Brain tumor		2
Trauma		2
Senile		2
Epilepsy (idiopathic)		1
Major psychoses (functional)		9
Psychoneurosis		1
Total admissions		38

over-all physical picture will be considered.

In an ordinary neuro-ophthalmologic study, the history, visual acuity, visual fields, and ocular-motility studies are largely depended upon for diagnosis. With the noncoöperating patient, we are limited principally to a consideration of the position of the lids, the orientation of the visual axes of the two eyes, gross evidences of trauma, and to the study of the pupils and the fundus oculi. The fundus examination is the *sine qua non* of every neuro-ophthalmologic examination

and must be performed even if it means the utilization of local anesthesia, lid speculum, and fixation forceps.

In each of these cases, an initial tentative impression will be presented, together with the findings on which it was based. Diagnostic studies and historical data will follow, with notation of subsequent revisions of the first impression.

EXOGENOUS TOXINS

ALCOHOL

In order to place the emphasis accurately, it is necessary to begin with the consideration of alcoholic psychoses—one group of mental derangements which presents no pathognomonic eye signs. However, in this institution, these patients form more than one third of all psychotic admissions, and, in the case of accident victims, it is at times necessary to employ our meager eye findings in differentiating between intracranial trauma, traumatic psychosis, and acute alcoholism.

In acute alcoholism, characterized by coma, delirium tremens, or impending delirium tremens, it is common to find dilated pupils, with sluggish reaction to light and limited pupillary excursions. Conjunctival injection, both bulbar and palpebral, is usual. In some patients nystagmus is observed. A very characteristic subjective finding is the presence of visual hallucinations.^{16, 21} Rea³⁰ states that a helpful finding is that of retinal arteriosclerosis, out of proportion to the age of the individual, and he even suggests that one might differentiate the arteriosclerosis of alcoholics from the senile type. One author has observed bitemporal pallor in 20 percent of patients showing alcoholic psychosis.¹⁹

CASE 1. L. J., a white man aged 44 years, was admitted to Hines with complaint of visual hallucinations—moving

circles, polyopia, dogs, and cats. He had been "nervous," with tremors of the extremities, and unable to sleep. He could not remember his actions during the night preceding his hospitalization. He felt that his condition was due to the "flu," but he believed he had been drinking—to help his nervousness—about 1½ pints of whiskey daily.

Physical examination. The patient was somewhat emaciated and had coarse tremors of the extremities and tongue and grossly impaired coordination. There were no other physical findings.

Eye examination. The pupils were moderately dilated, equal, and round, with sluggish reaction to light. Ophthalmoscopic examination showed mild retinal arteriosclerosis, evidenced by increase in the width of the central arterial light streak, and moderate compression of the veins at the arteriovenous crossings. There was no retinopathy. The tentative diagnosis was: Delirium tremens.

At a subsequent interview with the patient it was learned that he had been drinking large amounts of liquor daily for five years. He had had progressively increasing tremors for the past six months, relieved by whiskey. His memory was poor, his intelligence average. He had lost 20 pounds in the past few years. Laboratory reports showed an erythrocyte count of 3,650,000 with hemoglobin of 75 percent.

Final diagnoses were: (1) Psychosis, alcoholic, delirium tremens, recovered. (2) Chronic alcoholism.

DRUG ADDICTION

Morphine and opium addiction are far less common than alcoholism. If the indulgence has been sufficient to effect the victim's cerebration, it is usually possible to note the characteristic miosis.³⁰ There are no other significant ocular findings.

CASE 2. R. A. H., a white man, aged 54 years, was admitted on January 29, 1945. He desired relief from morphine addiction and treatment of precordial pain. The patient stated that he was a heavy drinker, had been suffering from recurrent anginal pain for two years, and had begun to use morphine for relief of the pain.

Results of his physical examination were negative, as were the laboratory findings. The electrocardiogram showed possible old myocardial infarction.

Eye examination. The pupils were 2.0 mm. in diameter, round, and reacted to light. The ophthalmoscopic examination was negative.

The patient had become habituated through the influence of a brother who was a morphine addict, using an average of six quarter-grain doses daily (mild addiction). The patient seemed to have subnormal intelligence, but was well oriented; he was sullen and quietly defensive about attempts to eliminate his addiction. His attitude, at best, was one of passive coöperation. Gradual withdrawal of the drug was effected. The prognosis for continued abstinence was guarded.

Final diagnoses were: (1) Drug addiction, morphine. (2) Psychopathic personality. (3) Coronary arteriosclerosis with myocardial damage.

Comatose or other psychotic states produced by various noxious stimuli (such as barbiturates, carbon monoxide, lead, and arsenic) were not observed during the period covered by this paper. Lead encephalopathy, with epileptiform seizures and papilledema, and barbiturate intoxication, with deep coma and dilated pupils, are encountered occasionally at this institution.^{1, 8, 30}

ENDOGENOUS TOXINS

DIABETIC COMA

One would expect to find a fertile field

for the ophthalmologist in the differential study of diabetic states. The much-described fundus changes^{12, 24} and the frequent hypotony should provide one with an almost certain basis for a tentative diagnosis of diabetic coma. Practically speaking, no such cases were encountered for the reason that the majority of diabetics arrive at Hines with the diagnosis already established.

UREMIC COMA

The same statement does not hold true for uremia. Not infrequently, the ophthalmologist's suspicion of uremic coma, based on the fundus examination, anticipates the results of the emergency blood-chemistry studies.

It is well to remember that there is no single pattern of fundus findings in uremia, for the term refers, not to a disease, but to a state of pathologic physiology (renal insufficiency) seen in the advanced stages of several types of disease. It may result from primary vascular causes, as arteriosclerosis or essential hypertension; or from primary renal pathology, as glomerulonephritis; or the end results of pyelonephritis. Therefore, the retinal changes may be predominantly vasosclerotic, or they may show characteristics of renal retinopathy—cotton-wool exudates, pleomorphic hemorrhages, and, in some cases, a macular star figure. In either event, retinopathy is an almost constant finding. Foster Moore noted its presence in 19 of 20 patients dying of uremia.^{24, 30} Edema may involve the posterior pole of the fundus, or it may be limited to the disc. Preceding a state of uremic coma, the patient may complain of headache, may be delirious, or have convulsive seizures.

CASE 3. J. W., a Negro aged 45 years, was disoriented on admission, showed marked disturbance of equilibrium, and

could not give coherent answers to the questions of the examiner. The patient was somewhat emaciated. He had occasional spasmodic twitching of one extremity and showed a sustained hyperkinesia. His temperature was moderately elevated.

Eye examination. The pupils were equal and round and reacted normally to light and accommodation. Both fundi showed marked arteriospasm, with arteriovenous ratio of 2:4 to 2:5. Sclerotic vessel changes were less pronounced. There were scattered soft cotton-wool exudates and numerous superficial striate hemorrhages. The retina of the right eye showed a 4-disc-diameter area of sharply circumscribed subretinal edema in the superior temporal quadrant. There was no measurable elevation of the discs. Neurologic examination was negative except for generalized cutaneous hypalgesia. Blood pressure was 180/120. Tentative diagnosis was: Toxic delirium of uremia, due to hypertensive renal-vascular disease.

In subsequent consultation with the department of medicine, it was learned that the patient was known to have hypertensive cardiac disease. Laboratory studies revealed an N.P.N. of 200 mg. percent, urea nitrogen of 83.6 mg. percent. Spinal-fluid protein was 90 mg. percent, it being under an initial pressure of 300 mm. of water. Urinalysis showed 2+ albumin, but no casts. At a previous admission, four months earlier, the blood-chemistry findings had been normal; the urine had shown 1+ albumin. Within 48 hours the patient lapsed into coma, from which he did not recover; no significant changes were noted in the retinal picture.

Final diagnoses were: (1) Toxic delirium, due to uremia. (2) Arterial hypertension, systemic. (3) Myocardial insufficiency. (4) Nephritis with nitrogen retention.

The preceding case illustrates one point

in diagnosis which must be considered; namely, the differentiation of toxic delirium associated with hyperpyrexia. In this patient, the characteristic retinal findings, the high blood pressure, and the moderate degree of fever militated against such a diagnosis. However, where the temperature elevation and degree of toxicity are marked (as in typhoid fever, malaria, and pneumonia) the pupils may be dilated, and the ophthalmoscope may reveal retinal hemorrhages.¹² These febrile delirious states are usually diagnosed after the infectious process has been identified.

CEREBRAL VASCULAR DISEASE

CEREBRAL VASCULAR ACCIDENTS

Cerebro-vascular accidents rank high among the causes of disturbances of the psyche, particularly coma. Ordinarily, the ocular examination gives little information regarding the general nature of the vascular accident, whether it be an embolus, thrombosis, or rupture of a cerebral vessel. However, the fundus examination is of some assistance in determining the etiology, especially in hypertension and arteriosclerosis. The pupils and orientation of the eyes are of localizing and, therefore, prognostic value. Anisocoria, with preservation of reaction to light, is common; the dilated pupil is most often ipsilateral to the hemorrhage, and the corneal reflex may be lost on that side. In cases of superficial hemorrhage or involvement of the internal capsule there may be head rotation and conjugate deviation of the eyes, both towards the affected side. Hemorrhage into the pons may induce opposite conjugate deviation, with ipsilateral facial-nerve involvement. In some of the latter lesions, extreme miosis may occur, as a result of irritation of the brain stem.^{18, 20, 24, 27, 32}

In general, the hemorrhages are more likely to induce deep coma and a terminal

picture than are the thromboses. A problem in objective diagnosis—the differentiation of hypertension from brain tumor in the comatose patient who presents papilledema and hemiplegia—will be considered in the discussion of papilledema.

CEREBRAL ARTERIOSCLEROSIS

It is, of course, apparent that the symptom complexes due to arteriosclerosis are innumerable, depending upon the predominant site of involvement. In older patients there are, however, a number of more common characteristic findings. There are tendencies toward impaired motor coordination, amnesia, and defective judgment. Reaction times increase and, in severe cases, the pathologic changes resulting from arteriosclerosis may produce apathy, or coma, quite apart from the vascular accidents which may occur in these patients.²⁴ It is recognized that the presence and degree of retinal arteriosclerosis are not an invariable index of a similar cerebral picture; nevertheless, the correlation is sufficiently high to render the ophthalmoscopic examination of prime importance in the diagnosis of cerebral arteriosclerosis.¹²

The following case history is presented of a man with typical cerebral arteriosclerosis in whom the fundus findings were less pronounced than the cerebral sclerosis. It will be obvious that an initial differentiation between cerebral arteriosclerosis and senile dementia is difficult, but the general picture and fundoscopic examination separate this patient readily from one suffering from uremia, diabetic coma, syphilis, or trauma.¹⁹

CASE 4. J. E. A., a Spanish-American War veteran, aged 73 years, was admitted to Hines on a stretcher. His son, who accompanied him, did not remain for an interview. The patient was completely disoriented: he lay with his eyes closed,

hands folded, in no apparent distress. In reply to most questions, he mumbled: "I am an old man, almost 70!" He spoke of having been dead for two years. His speech was thick, jumbled.

Physical examination. The patient was a huge, obese, entirely uncoöperative old man. Mucous membranes showed dehydration. The blood pressure could not be obtained by auscultation, but was estimated to be 120, systolic, by palpation. Heart sounds were distant. An indistinct mass was palpated in the right lower quadrant.

Eye examination. The pupils and ocular movements were normal. Corneal reflexes were diminished bilaterally, and the left palpebral fissure was slightly wider than the right.

Ophthalmoscopic examination. There was diffuse retinal arteriosclerosis, but the optic discs appeared normal, and there was no retinopathy. The neurologic examination elicited diminished responses to all sensory stimuli. There were no other definite neuropathologic findings.

This patient presented only: (1) mental changes; (2) an abdominal mass; (3) dehydration, and (4) retinal arteriosclerosis. The tentative diagnosis was: (1) Cerebral arteriosclerosis, advanced; and (2) by inference, generalized arteriosclerosis.

Laboratory studies showed a slight albuminuria, negative blood Kahn and Wassermann tests. N.P.N. was 35.0 mg. percent, creatinin 1.4 mg. percent; sugar 121.2 mg. percent, and chlorides 512.0 mg. percent. The leukocyte count was 7,300; erythrocyte count 4,400,000. The spinal fluid was clear, under no increased pressure; the Wassermann reaction was negative, and the gold curve normal (0012221000). The electrocardiogram revealed marked left axis deviation; and the chest X-ray study was not abnormal.

The patient's mental reaction im-

proved somewhat under cautiously administered parenteral fluids. After four days, the son returned and stated that the patient had never been ill until six years ago, when he began to show memory changes, irritability, and loss of appetite. For eight months prior to admission, he had eaten no solid foods and had become progressively less active, remaining in bed for most of the two months preceding hospitalization. The patient remained bedfast, pursuing a gradual downhill course, developed bronchopneumonia, and died on the 23d hospital day.

Final diagnoses were: (1) Psychosis with cerebral arteriosclerosis. (2) Bronchopneumonia, terminal.

Post-mortem examination revealed generalized arteriosclerosis, involving brain, heart, kidneys. There was right hydro-nephrosis and bronchopneumonia.

HYPERTENSIVE ENCEPHALOPATHY

In considering the patient just described, no mention was made of hypertensive encephalopathy as a possible causative factor for the reason that the condition is ruled out, with certainty, by the absence of hypertensive neuroretinopathy. The nerve-head involvement and retinal picture of severe hypertension are invariable accompaniments of the cerebral changes.

The cerebral changes associated with hypertension are characterized by headaches and, in severe cases, convulsions and coma, the manifestations being explained on the basis of anoxia resulting from cerebral edema. Some patients present, on the same basis, a less fulminating picture characterized by loss of orientation, retarded cerebration and other signs of degeneration. There is, in general, a significant correlation between the degree of papilledema, cerebral edema, and the elevation of spinal-fluid pressure.²³ The fulminating encephalopathies are apt to be

characterized by predominance of edematous qualities in the retinopathy, whereas those presenting the picture of mental deterioration will be likely to have a greater sclerotic factor in the fundus picture. The latter group is well illustrated by the following case.

CASE 5. W. F. L., a white man aged 52 years, was admitted to Hines on a complaint of "weakness." He was a small, underweight man, who shuffled about slowly, exhibiting pronounced emotional flattening. He was uncertain whether he had arrived from Chicago or Wisconsin; he believed he was about 40 years of age and had been in the United States since 1926. Identification papers indicated that he had been in the United States Army during World War I. The patient spoke only when questioned and required considerable prodding. He was disoriented for time and place; he showed gross debility of his intellect, and his arithmetic ability was limited to multiplying 2 times 2. There was obvious gross impairment of memory. He was able to care for himself without difficulty.

Neurologic examination. There was muscular wasting with loss of muscle power, but good coördination and no tremors. The cranial nerves were normal, as were the reflexes.

Eye examination. The pupils were 6.0 mm. in diameter and responded to light stimulus with only a limited sluggish contraction. *Ophthalmoscopic examination.* Bilateral papilledema of 2D. was present, with peripapillary retinal edema and numerous hemorrhages and exudates about the discs. In the macula of the right eye were conglomerate small, "hard" exudates, with others scattered throughout the posterior retina. Edema of the macula of the left eye was accompanied by some radially disposed streaks of exudate. The arteries showed marked focal narrow-

ings, with increased central light streak, and the veins showed engorgement and tortuosity. The arterio-venous ratio was 2:4 to 2:5. The tentative diagnoses were: (1) Hypertensive encephalopathy, and (2) alcoholic psychosis, with brain tumor to be excluded.

Further physical examination. A blood pressure of 200/145 was present together with moderate sclerosis of the radial arteries and cardiac enlargement. Results of laboratory studies were: normal cranial X rays; urinalysis and blood Kahn negative; N.P.N. was 35 mg. percent, urea nitrogen 14.9 mg. percent, and blood sugar 112.4 mg. percent. Spinal-fluid manometrics were not done, but the fluid was clear, slightly xanthochromic, with 3 cells per cubic centimeter. Wassermann and gold-curve tests were negative.

Continued observation of the patient discovered no change in signs or symptoms, and the considerations of alcoholism and brain tumor were relegated to the background. The absence of acute cerebral symptoms correlated well with the prominent factor of sclerosis in the patient's neuro-retinopathy.

Final diagnoses were: (1) Psychosis with hypertensive encephalopathy. (2) Hypertension, arterial, with myocardial damage. (3) Arteriosclerosis, generalized, moderate.

SYPHILIS

Acute inflammations (epidemic encephalitis, meningitis, brain abscess) may not properly be considered in this discussion, since they were not encountered on my ward. Of the chronic inflammations, those manifested by a solitary lesion, as for example in tuberculosis, will be considered with neoplasms. Syphilis merits special attention because of characteristic eye findings, and also because of the necessity of recognizing psychotic manifestations of syphilis in accident cases.

The ocular changes of syphilis are too numerous to record in detail here. Patients with meningo-vascular syphilis may show psychic disturbances, depending on the extent of encephalitis, but usually the base of the brain is involved, with ocular-muscle pareses, and unpredictable pupillary abnormalities. More often, in the disoriented patient, the problems of paresis and tabo-paresis must be considered. Here, the Argyll Robertson pupil and ophthalmoscopic findings of primary optic atrophy (both much more common in tabes than in paresis) provide the chief ocular diagnostic support. Paralytic strabismus, usually related to the oculomotor nerve, is uncommon in paresis; such a finding suggests a combination of paresis and tabes dorsalis. The Argyll Robertson pupil occurs in about 50 percent of parietic patients, but other forms of pupillary abnormality are noted; namely, frozen pupils, anisocoria, and dyscoria.^{16, 24, 30}

CASE 6. L. M., a white man aged 50 years, was admitted to Hines for treatment of a fracture of the left humerus and olecranon. The physical examination was negative except for (1) the left arm, and (2) small, irregular pupils. Blood Kahn and Wassermann reactions were negative. Shortly after open reduction of the left elbow was performed, the patient began to show signs of mental deterioration and was transferred to the psychiatric ward for observation.

The patient coöperated well during interview and examination, but showed grossly defective judgment, and his history was later found to be inaccurate. He stated that he had had a diagnosis of syphilis made 10 years ago. The *neurologic examination* was entirely negative except as follows:

Eye examination. The pupils measured 2 mm. in diameter, were irregularly

round, and showed a slight paradoxical dilation to light and reduced constriction in accommodation. The optic discs, retina, corneal reflexes and ocular motility were normal. Despite the negative results of blood tests and physical findings, a tentative diagnosis of paresis was based on the pupillary changes, and the patient's admission of a syphilitic infection.

The Wassermann test, repeated, was again negative, the Kahn was equivocal. Spinal-fluid examination revealed 100 percent positive Wassermann reaction in all dilutions, with a syphilitic colloidal gold curve (0012332100).

Final diagnosis was: (1) Psychosis, with syphilis of the central nervous system, meningo-encephalitic (paresis). (2) Fracture, humerus, left. (3) Fracture, olecranon, left.

One interesting patient presented the problem of differentiation between paresis and posttraumatic psychosis.

CASE 7. R. J. W., a white man aged 54 years, was admitted to Hines for treatment of a fracture of the right leg, both bones, sustained one day earlier.

Physical examination was impossible, on admission, as the patient was agitated, fought with attendants and doctors and refused to permit anyone near him. He was more approachable after 48 hours; he assumed a semistuporous attitude, lying motionless with eyes closed, and responded very sluggishly to commands and questions. He was disoriented, but remembered having been pushed from an "L" platform, as the crowd surged into a waiting train. His memory for subsequent events was poor. His speech was thick and slurred.

The necessity for differentiating between head trauma and posttraumatic psychosis was suggested at first, but the neurologic examination revealed markedly diminished knee-jerk and Achilles

reflex on left, and faulty toe-position sense. (The right lower extremity was in a plaster cast).

Eye examination. The pupils were unequal, that of the right eye measuring 3.0 mm., left 1.5 mm. in diameter. The pupil of the left eye was irregularly round; neither reacted to light, but both reacted to accommodation. The *ophthalmoscopic examination* showed marked yellowish pallor of both optic discs.

A diagnosis of tabo-paresis was now entertained, and was confirmed by the laboratory findings; blood and spinal-fluid Wassermann reaction 100 percent positive; Kahn test, 2+; parietic gold curve (5555432100); negative skull X-ray studies.

Final diagnosis was (1) Psychosis, with syphilis of the central nervous system, meningo-encephalitic (paresis). (2) Fracture, both bones, right leg.

HEAD TRAUMA

The accident victim usually presents no problem with regard to the cause of his disability but, in some cases, gross evidences of trauma and a reliable history are lacking. Approximately 80 percent of patients with head injuries show ocular signs—in most instances, pupillary abnormalities. The pupils are usually small at first, sometimes fixed, as a result of irritation. In shock, they may be dilated, reacting to light. Bilateral, dilated, fixed pupils are considered a grave prognostic sign.¹³ If there is intracranial bleeding or hematoma, one pupil may be dilated, but opinions differ as to whether the dilated pupil is a reliable index for lateralization of the hemorrhage. Dilatation of the pupil resulting from interruption of the afferent pathway may be ruled out by the consensual light reflex.^{20, 33}

Conjugate deviation of cortical origin is usually transient; the direction of the deviation depends on whether the cortex

is irritated (toward) or nonfunctioning (away from).⁷

The fundi may show retinal edema, but papilledema does not ordinarily appear before three to eight days. Peripapillary and diffuse retinal hemorrhages suggest subarachnoid bleeding.^{3, 18} Hemorrhages into the lids and conjunctiva have some diagnostic significance, slow-appearing ecchymosis suggesting anterior cranial-fossa fracture rather than local orbital trauma.³⁴ The following case history illustrates the problems in diagnosis of trauma in the "out-of-contact" patient.

CASE 8. D. M., a white man aged 53 years, was admitted to Hines in a stuporous condition. A taxicab driver had found him lying unconscious in the street, a pool of blood about his head. After some time the patient became sufficiently responsive to recollect that he had set out on a drinking party, but he could recall nothing thereafter.

Physical examination. There was no gross evidence of fractures.

Eye examination. Right eye. The lids were intensely edematous and ecchymotic, with marked proptosis of the eye and orbital contents. The bulbar conjunctiva was ecchymotic and there was massive intraocular hemorrhage.

Left eye. A small subconjunctival hemorrhage was present on the bulbus; the pupil was normal in size and reactions; the fundus showed normal disc and retina with moderate retinal arteriosclerosis. A tentative diagnosis was made: (1) alcoholism, acute (2) hemorrhage, right eye and orbit.

This patient presented the question of differentiating head injury from alcoholic stupor, without the benefit of comparison of the two pupils. The abrupt, massive orbital hemorrhage was not especially indicative of skull fracture, and the fundus of the left eye showed no hemorrhage

nor edema. The patient was observed and showed progressive improvement in his cerebral activity. Skull X-ray pictures showed a probable fracture of the right zygomatic process, but no other evidence of fracture. Spinal-fluid examination was entirely normal.

Final diagnoses were: (1) Psychosis, alcoholic intoxication. (2) Exophthalmos, right, due to orbital hemorrhage. (3) Intraocular hemorrhage, massive, with subconjunctival hemorrhage, right.

BRAIN TUMORS

Any discussion of neuro-ophthalmologic significance will ultimately focus on the consideration of brain tumors, since papilledema may be observed in 80 percent of these patients.¹⁴ Moreover, brain tumor is responsible for about 80 percent of all papilledemas. The expression "brain tumor" is used here to refer to all space-taking, intracranial lesions, benign and malignant, granulomatous or vascular. The signs and symptoms in brain tumor are referable to (1) destruction of brain substance by tumor; (2) pressure on the brain resulting from increased intracranial pressure and cerebral ischemia. Papilledema is a manifestation of the latter mechanism, and is, therefore, of little localizing value. However, because of its frequency, the implications of the finding of papilledema cannot be overemphasized, and it is of paramount importance to be able to differentiate papilledema from optic neuritis, pseudoneuritis optica, and other, similar fundus changes.¹⁴ For the patient's good, a nerve-head swelling must be considered a sign of brain tumor until proved otherwise. Abducens palsy may occur in increased intracranial pressure. Pupillary changes, corneal anesthesia, conjugate ocular deviations, and ophthalmoplegias may assist in the localization of an intracranial mass. Our first consideration, however, is to es-

establish or rule out the existence of a tumor, and although this, as a rule, is a relatively simple matter, pitfalls are many in the disoriented or comatose patient, who usually cannot relate the usual story of headaches, projectile vomiting, convulsive seizures, and progressive mental changes. In some instances, papilledema may be the only objective finding, as is illustrated by the following patient.

CASE 9. F. M., a white man aged 52 years, was admitted because of psychotic episodes, loss of memory, and urinary incontinence. The patient was unable to supply a coherent history. He showed marked emotional swings, and was extremely garrulous. His story centered repeatedly on his past as a baseball player and his inability to remember anything since he became ill. He thought he had been to a place where they had "16 doctors" and where he had had an operation of some sort. He was disoriented for time and place. His conversation was completely incoherent. His response to the question: "Who are you?" was: "Well, let's see, you work for the railroad, I mean the rain—let me see, March, April, May, I can't remember anything since I've been sick." The neurologic examination was negative except for an equivocal left facial weakness and a suggestive Babinski on the left.

Eye examination. The pupil of the right eye was round, 5 mm. in diameter, and reacted to light and accommodation. The left eye was slightly proptosed, and the iris was darker than that of the right. There were no abnormalities of the extraocular muscles. The fundi showed hyperemia of the discs with increased capillary visibility and obliteration of the disc margins. Elevation of each disc was less than one diopter. No hemorrhages nor exudates were found. The remainder of the physical examination was negative.

The tentative diagnosis was: Brain tumor, left frontal.

History from the patient's wife subsequently disclosed that he had had a convulsive seizure 10 weeks prior to this hospitalization. He had been hospitalized elsewhere and studied, with no etiologic findings. After 10 days, the patient began to have memory defects, attacks of amnesia and severe left-sided headaches, and he was again hospitalized. At the second hospitalization, "air X rays" were taken of the brain, and the wife was told that the patient had an inoperable brain tumor, for which the only treatment recommended was a palliative decompression. This treatment was refused, and the patient remained at home until the severity of his headaches made it necessary to hospitalize him at this time. The wife told of a series of attacks of iritis (left eye) during the eight years preceding hospitalization; the last attack, one year ago, was accompanied by secondary glaucoma. Laboratory studies showed slight albuminuria, but no other abnormalities. Skull X-ray films showed only the circular trephine openings of the previous ventriculogram. The chest X-ray study was negative.

The patient was discharged from the Hospital against the advice of the staff and was brought back one month later in terminal condition. He expired within two days. Permission for post-mortem examination was refused.

Final diagnosis was: (1) Psychosis with brain tumor, left fronto-temporal.

The presence of papilledema in cases of brain tumor must be differentiated from papilledema in hypertension (with associated increased intracranial pressure). Erroneous conclusions in this regard may be responsible for serious inconvenience to the patient, as is shown in the following case history.

CASE 10. P. A. J., a white man aged 50 years, was admitted to the Hospital for the treatment of right hemiplegia. On admission the patient was semi comatose, aphasic, and incontinent. His wife stated that he had a "stroke" while working as a brick layer one week earlier. He was unconscious for 24 hours, and had been in a stuporous condition since then. There had been no previous illness, nor mental symptoms, and no direct history of trauma. His physical examination revealed a blood pressure of 180/125, with no cardiac abnormalities.

Neurologic examination. A right facial weakness was established, with severe right hemiplegia and aphasia. Relative hypesthesia was present in the right half of the body.

Eye examination. The pupils and pupillary reactions were normal; the fundi showed bilateral papilledema of 4 to 5 diopters, with hemorrhages confined to the surface of the disc and adjacent retina. The veins were engorged, and the arteries showed moderate generalized attenuation without notable increase in the light streak and with few focal arterial constrictions.

The initial differentiation lay between cerebral hemorrhage, with arterial hypertension, and tumor on the left side of the brain. Spinal puncture was carefully performed. The intrathecal pressure was 400 mm. of water; there were no red cells and no xanthochromia; all other spinal fluid and other laboratory findings were negative. An electrocardiogram was negative.

Influenced by the clear spinal fluid, and by the apparent disproportion between the severe papilledema and paucity of other cardiovascular findings (the blood pressure on some occasions did not exceed 150/95), the neurologists and the writer offered the diagnosis of brain tumor, left fronto-parietal. The ophthal-

mologic consultant in his report recommended further consideration of a vascular etiology, based on the attenuated retinal arteries. Skull X-ray films were normal, except for a slight shift of the pineal to the right. Although conceding that the "onset is rather peculiar for a tumor," the neurosurgical consultant was impressed by the pineal shift, and agreed with the neurologists' diagnosis. An osteoplastic craniotomy was performed. No brain tumor was found, and the dura mater was not under tension. In the motor area, the cerebral cortex was yellowish, softened, and many completely thrombosed small veins were visible; there was evidence of a thrombus in the Sylvian vein.

Final diagnosis was: (1) Cerebral thrombosis, left, with infarction, producing hemiplegia, right. (2) Arterial hypertension, moderate.

Another knotty problem frequently encountered in the psychiatric wards is the ruling out of brain tumor in young adults tentatively labeled as "dementia praecox," "psychopathic personality," or "psychoneurosis, severe." In each instance it is essential to undertake as careful an eye examination as is permitted by the coöperation of the patient.

CASE 11. M. D. D., a white man aged 23 years, was admitted to the Hospital because of amnesia of one week's duration. According to his wife, the patient came home from his job as a bus driver, eight days prior to admission, went to sleep for four hours, and when he awoke he was completely amnesic for his surroundings, family, and his own identity. He went to a movie to "try to remember," but he seemed very apprehensive. His only apparent recollection was that he had a key which he recognized as belonging to his mother's house. He was

hospitalized elsewhere for one week, then transferred to this Hospital.

It was learned that the patient had been going with another woman, had been gambling, and had taken some of the bus company's money to cover his losses. It was felt that the patient's amnesia was on an hysterical basis, as an escape from the consequences of his domestic difficulties. He had previously complained of right temporal headaches.

Physical examination. No abnormality was found except for a fullness (about 5 cm. in diameter) of the skull over the right temple; this prominence was elevated about 1 cm. The *neurologic examination* was also negative.

Eye examination. The pupils were normal, but the eyegrounds showed $1\frac{1}{2}$ D. elevation of the discs with hyperemia and obscuration of the disc margins. There were no hemorrhages nor exudates. The veins were moderately distended, and the arteriovenous ratio was 1:2, but there was no significant venous nicking at the arterio-venous crossings. The fundus picture was interpreted as a probable papilledema, but it was considered "compatible with pseudoneuritis optica." The ophthalmologic consultant made a diagnosis of papilledema, bilateral. Laboratory studies and skull X-ray films were negative.

A tentative diagnosis was made of a space-occupying lesion of the right fronto-temporal region, based on the headaches, amnesia, the bony asymmetry, and the papilledema. The patient's attitude toward his wife and the Hospital was one of hostile suspicion, and he refused further neurologic diagnostic procedures. The final diagnosis was, therefore, not proved but was placed on the record as "brain tumor, probable, right frontal."

Although the patient had adequate basis for a hysterical amnesia (from

which he fully recovered during his hospitalization here), the findings necessitate his classification as a brain-tumor suspect until disproved.

Discussion of the subject of brain tumor would be incomplete without a word concerning the necessity for repeated ocular examinations in disoriented or comatose patients, whether or not they are direct tumor suspects. This is especially true in older persons, to whom the diagnosis "cerebral arteriosclerosis" and "senile dementia" may be too indiscriminately applied.

CASE 12. F. B., a Negro aged 57 years, was admitted for the treatment of psychosis and "stroke." Diagnosis had been made of: (1) Psychosis with cerebral arteriosclerosis; (2) Right hemiplegia, due to left cerebral thrombosis.

Eye examination. The eyegrounds evidenced only moderate retinal arteriosclerosis. The history had indicated some gradual loss of memory and progressive weakness of the right arm and leg. There had been no history of headache prior to admission to the Hospital. The patient had been losing weight for six to eight months.

During the first two months of hospitalization, there was some limited improvement in the hemiplegia, but the patient began to have frontal headaches and lost weight progressively. The weight loss was dismissed as incidental to his chronic illness and bed-ridden state, and analgesics were used for control of the headaches. After two months, he became confused, completely disoriented, and markedly apathetic. Physical examination was repeated, and at this time there were approximately 4 diopters of papilledema bilaterally, with distension and marked tortuosity of the veins. The arteries showed slight attenuation and increase in central light streak. By gross confronta-

tion testing, a right hemianopia was observed. The remaining physical examination showed marked emaciation, blood pressure of 110/72, and liver markedly enlarged to percussion. Neurologic examination confirmed the previous right hemiplegia. At this time, the diagnosis was revised to: (1) Brain tumor, left frontal, probable; "the hemiplegia" was still felt to be on a thrombotic basis.

X-ray films were not helpful. Blood-pressure studies showed no elevation. Blood N.P.N. was 19.2 mg. percent, creatinin 1.9 mg. percent. Léukocyte and erythrocyte counts were normal, as were P.S.P. renal-function test, a G.I. series, and X-ray studies of all bones. On further observation of the fundi, several fresh hemorrhages were discovered. The globulin content of the spinal fluid was increased, but there were no other abnormalities. The neurosurgical consultant concurred in the diagnosis of probable brain tumor, and recommended ventriculography, but suggested that the patient was too ill to warrant the procedure. The patient continued to go downhill rapidly and expired four weeks after the diagnosis of brain tumor was suggested.

Final diagnoses were: (1) Brain tumor, left frontal lobe. (2) Hemiplegia, right.

The pitfalls are many in diagnosis of brain tumor from ocular findings, and each misstep points up the necessity for better and more detailed study on the next patient.

EPILEPSIES

Of the patients admitted to the Hospital for etiologic investigation of epileptic seizures, many were soon recognized as symptomatic of organic brain lesions such as tumor and cicatrices. Of the remainder, the "idiopathic" epilepsies, only a few were observed during seizures.

In these seizures, pupillary changes and abnormalities of the position of the eyes and lids depend on the area of the brain stimulated; thus, the eye findings have a localizing value. In generalized (grand mal) seizures, the eyes may be fixed, staring, or they may rotate upward. In Jacksonian (unilateral attacks), conjugate deviation of the eyes and of the head, to the contralateral side, may be induced; if the facial musculature is involved, an orbicularis spasm may occur.

A simple "adversive" seizure—unconsciousness, with head and eyes turned to one side—suggests contralateral frontal-lobe stimulation. In subcortical (extrapyramidal) attacks, the head is thrown back, and the eyes rolled upward, a position that may be sustained for many minutes. If the diencephalon is involved, the eyes may be wide open and fixed; the pupils dilate during the attack and later contract.²⁹

One mentally deteriorated patient, who was repeatedly observed in grand-mal seizures, illustrates the usual pupillary changes.

CASE 13. C. H., a married white man aged 29 years was admitted to the Hospital because of progressive signs of mental deterioration. One year prior to Hospital admission, the patient had attempted to choke his mother during a quarrel; six months before, he had set upon his grandmother during an argument resulting from his suspicions that his sister was "running around." He had periods of disorientation and poor memory, with occasional delusionary experiences.

The patient's wife, a nurse, stated that he had had epileptiform seizures, at long intervals, for five or six years, and had been under investigation and treatment with dilantin sodium prior to this Hospital admission. There had been several

episodes of head trauma in the patient's lifetime.

His mental examination revealed him to be disoriented, childish in his responses, with loss of memory, and illusionary experiences. Physically, he was tall and slender. He had several healed scalp wounds. Laboratory examinations and spinal-fluid study were without significance. Skull X-ray films showed an old linear fracture line.

During the period of hospitalization, the patient had four epileptic seizures of the grand-mal type. In each instance, there were universal contractions, unconsciousness, and sonorous breathing. The pupils were always dilated during the attack, and on one occasion were noted to be unequal in size. The palpebral fissures were wide; the eyes were not deviated. In the somnolent period following each seizure, the pupils became small again.

The final diagnosis was: (1) Epilepsy, idiopathic (grand mal and petit mal). (2) Psychosis with epileptic deterioration.

THE MAJOR PSYCHOSES

Although the functional psychoses (dementia praecox, paranoia, involutional melancholia) constitute the second most frequent group of admissions to the psychiatric ward, nothing peculiar to these diseases has been observed in the ocular examinations. The examination is important, however, as one of the bases for ruling out organic brain diseases.

Holmes¹⁹ has reported a series of fundoscopic studies in 2,000 consecutive mental patients, in 20 percent of whom he was able to detect eyeground disturbances related to the etiology of the psychoses. Most of these findings occurred

in patients whose psychosis was on the basis of organic cerebral pathologic change—patients of the sort herein previously discussed.

CONCLUSIONS

Since neuro-psychiatric diagnoses are not predicated on eye findings alone, it is not to be considered that this paper subscribes to any such thought. Even for the ophthalmologic consultant, associated physical, neurologic, and laboratory findings must be considered in interpreting eye findings.

Based on examination of disoriented patients at Hines Hospital, the following generalizations may be made:

1. The ocular examination is of greatest significance in the early diagnosis of psychotic and comatose states resulting from: (a) brain tumor; (b) cerebrovascular diseases, especially hypertensive encephalopathy and cerebro-vascular accidents.

2. Of definite value, but less vital than the first group because of the ready availability of pertinent laboratory data, are the eye findings in: (a) uremic coma; (b) syphilis of the central nervous system.

3. In the two largest groups of disoriented patients—(a) acute alcoholism and (b) the major psychoses—the eye findings are of little or no diagnostic value.

4. In (a) diabetic coma and (b) head trauma, the eye findings, while often characteristic, are of little diagnostic significance because pertinent history is usually available.

5. In epileptic seizures, the eye findings may have localizing value in neurologic diagnosis.

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OPHTHALMOPEDICS

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The frequency of ocular and facial injuries in this war has added new impetus to the art and science of mechanical corrective devices in the field of ophthalmology and plastic surgery. At an Army ophthalmic center* many new ophthalmopedics have been developed.

Each ophthalmopedic is first made up in a combination of paraffin and base-plate wax. The working qualities of this mixture are ideally suited for use in and around the socket.

Depending upon the extent of the injury, undercuts, and compressibility of parts, the procedure in fashioning the wax pattern is by one of three methods: (1) In the direct method, the pattern is made directly on the patient's involved area, such as the socket; (2) in the indirect, the working up of the pattern is based on a plaster or stone model; (3) finally, in the indirect-direct wax-up, the wax pattern is made up on a reproduction of the patient's injury (in plaster or in dental stone), and is then tried and modified to fit correctly in its anatomic position.

After the wax pattern has been invested in a suitable dental flask, it is washed out and the mold is tin foiled. Methyl methacrylate in a heavy, doughy state is packed into the mold and is polymerized for three hours at 100°C. The ophthalmopedic is then polished and available for use.

Irrespective of the method utilized, extreme care must be exercised so that the device is of correct size, shape, and contour. Injury to the skin and mucous membrane is avoided by constructing these de-

vices so that they have no sharp margins or edges, and this is especially true of those which fit inside a socket. At the time of surgery the appliance is sterilized by immersing it in a germicidal solution† for 15 minutes. The entire surface of all appliances enters into contact with the germicide, including the lid-stretcher (fig. 6a). The latter is so constructed as to make its posterior section inseparable from the anterior, when it is in the socket and the lids have been joined by a tarsorrhaphy. Despite the lack of complete disassembly, the openings are made large enough to allow the germicidal solution to come in contact with all surfaces and thus render them sterile. In no case has an infection of the skin or of a mucous membrane followed the use of any of the ophthalmopedics.

With the exception of the conformers and implants required after enucleation, as will be discussed later, each deformity is a distinct problem requiring the construction of a special, individual device. The majority of deformities of the eye and its adnexa do not, however, require such appliances, and it is only at the request of the ophthalmologist that an ophthalmopedic is designed.

1. *Enucleation and Evisceration.* Early in World War II conformers were not universally available. As a result, a few sockets contracted during the interval of time between the enucleation or evisceration at a forward station and the fitting of an artificial eye at an eye center in the continental United States. Later,

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† Bichloride-of-mercury solution 1:1,000.

when conformers were inserted immediately after removal of the eye, these contractures no longer occurred. Many ophthalmologists use these conformers routinely.

As a standard procedure in 64 enucleations and 8 eviscerations, a conformer,

a perforation through the center for the escape of serum (fig. 1). We have seen no localized reaction from the use of socket conformers; on the other hand, they served to shorten postoperative recovery.

After enucleations, the implant used has been an acrylic sphere with serrations

Fig. 1 (Kohout and Calahan). Conformers for the conjunctival cul-de-sac after enucleation.

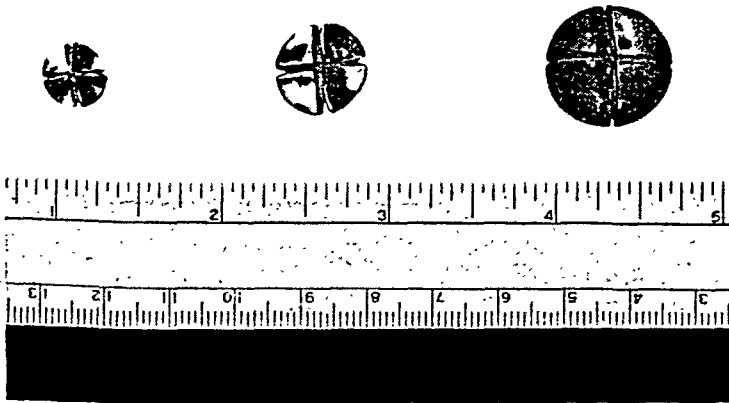
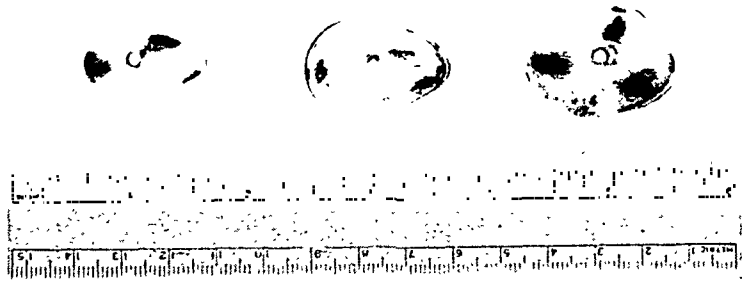


Fig. 2 (Kohout and Calahan). Implant spheres made of methyl methacrylate.

thinly coated with 5-percent sulfathiazol ointment, was inserted into the conjunctival cul-de-sac immediately upon the completion of the operation. The conformer assists the external elastic bandage to maintain the pressure on orbital tissues and prevent hemorrhage, makes impossible the prolapse of conjunctiva through the palpebral fissure, and maintains the surface area of the conjunctiva. Our conformers vary in size from 25 mm. by 20 mm. to 35 mm. by 25 mm. and have

(fig. 2), and we have observed only one extrusion.

2. *Contracted sockets.* Phimotic sockets due to the detachment of a canthal ligament, especially if no conformer has been inserted, present a difficult problem. This is overcome by using successively larger conformers (fig. 3a) which gradually increase the size of the socket. Progress was more rapid when a small mediolateral expanding device was in-



Fig. 3a (Kohout and Callahan). Successively larger conformers which gradually increase size of sockets. After the expanding device had been opened as fully as possible, it was closed, the caps were applied, and expansion continued. The entire procedure from the smallest to the largest size required five months.

sented. This was gradually opened, and later caps were added to produce further enlargement. Five months were required to expand the smallest socket to one amply accommodating a plastic eye (fig. 3b).

When a socket is reconstructed with skin, the exfoliation, discharge, serum,

and the like often interfere with good results. To maintain an ample fundus and to keep it cleansed, a special conformer with an irrigating system was devised (fig. 4). It may be placed in the socket



Fig. 3b (Kohout and Callahan). Mediolateral socket expander in place.



Fig. 4 (Kohout and Callahan). The flat base maintains the socket, is kept in place by subtotal tarsorrhaphy. The protruding barrel is placed at the inner canthus, and a standard syringe fits into it for irrigation with antibacterial solution.

at the conclusion of surgery and maintained *in situ* by a subtotal tarsorrhaphy until all contraction of the graft has ceased. Several times daily, the conformer may be flushed with cleansing solutions, or such antibacterial solutions as penicillin, the fluid being directed into the system by a syringe.

Occasionally entropion of the lower lid or a very shallow inferior fornix will develop as the socket contracts. If pressure is applied to the lid from the orbit by means of an apparatus which expands in its lower portion only, the entropion, in some cases, may be corrected without surgery (figs. 5a, b, c).

3. *Wrinkling of the skin in lid reconstruction.* In anophthalmic cases, after reconstruction of the upper or lower eyelid, or both, marked wrinkling of the graft has sometimes occurred despite a tarsorrhaphy. An instrument to correct this complication was suggested by Capt. Jerome H. Cohen (MC) and Capt. Seth Barron (MC). It consists of a posterior segment which rests against the orbital

tissues and an expandible anterior portion. In the first model, expansion was accomplished by a mineral-oil "pressure chamber," but this system had the disadvantage of requiring a cut-off valve, and the obvious defect of being subject to leakage. It was, therefore, discarded.

A lid stretcher, based on a mechanical-screw principle (fig. 6a), was evolved by the same investigators. It is placed in the socket, and after the adhesions of the



Fig. 5a (Kohout and Callahan). Force is applied to the inside of the lower lid, helping to lessen and sometimes even to correct entropion.

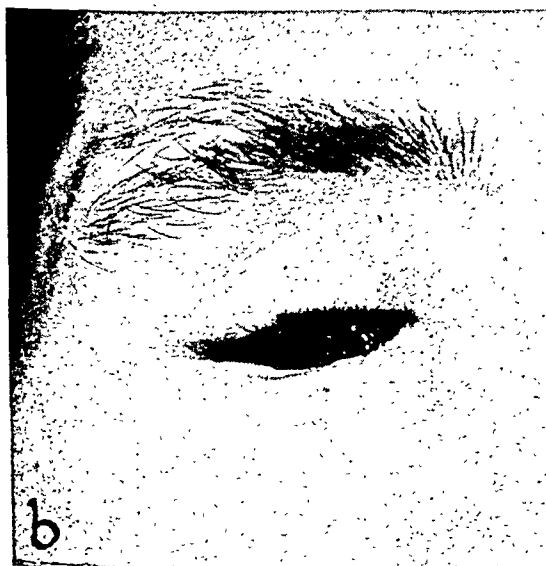


Fig. 5b (Kohout and Callahan). Cicatricial entropion, right lower lid. (Surgery by Lt. Col. John Pick.) Fig. 5c, Correction of entropion by device shown in figure 5a.

tarsorrhaphy have firmly united, the screw is turned, causing stretching—and therefore smoothing—of the skin (figs. 6b and c).

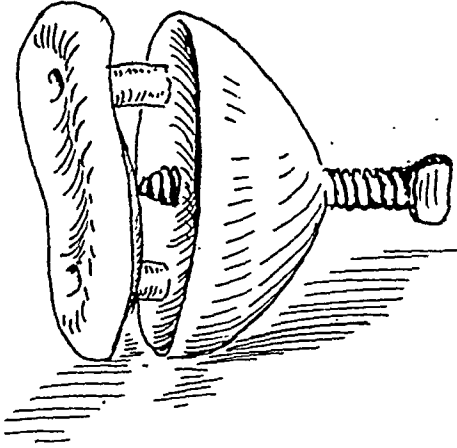


Fig. 6a (Kohout and Callahan). Turning of the screw causes separation of the anterior from the posterior segment. The two small guides prevent rotation of either section. There are small flanges at the end which prevent the separation of the segments.

4. *Edema of the lids.* In many cases of traumatic anophthalmos there is no support for the upper lid; and frequently, after dislocation of a lower lid, it hangs without support. Edema occurs because venous and lymph return is very poor.

Because of this and the additional factor of gravity, a cycle of reciprocal pathologic changes develop. As the edema increases, the lower lid acts as a valve closed upon itself. This defective metabolism lowers the vitality of the lid and increases the difficulty of reparative surgery.

The usual compression bandage rarely exerts the exact pressure required, and must be changed very frequently because of discharge around an abnormal socket. Lack of exposure to light and air often depresses the vitality of the tissues.

To overcome these disadvantages, external supports were developed for such lids, consisting of acrylic prostheses which use the most convenient bony support—the nasal, zygomatic, maxillary, and temporal bones (figs. 7a, b, c, d). In certain cases where external pressure alone was insufficient to give proper support, these devices were modified so that a portion extended inside the lid, and the latter was thus supported both from the anterior and inferior aspects (figs. 8a, b). A combined device to aid in rebuilding the socket with a ledge for the support of the upper lid is one of the many modifications possible (fig. 9).



Fig. 6b (Kohout and Callahan). After reconstruction of upper and lower lids, the graft shows considerable wrinkling. Fig. 6c, A subtotal tarsorrhaphy holds the lid stretcher in place. In three months, there has been considerable smoothing of the graft. (Surgery by Major Clement C. Clarke.)



Fig. 7a (Kohout and Callahan). Edema of lower lid which has assumed almost tumorlike proportions. The white discharge seen on the lower lid is pyocyanic discharge. Fig. 7b, Lateral view.



Fig. 7c (Kohout and Callahan). Acrylic pressure conformer in place. Fig. 7d, Appearance after two months just prior to surgery.

Fig. 8a (Kohout and Callahan). A shell fragment has caused loss of right eye, floor and medial wall of orbit, lateral wall of right nasal cavity, part of septum, and left lower lid. Upper lid, unsupported, is edematous. (Surgery in this case performed by Major Arthur J. Barsky.)



5. *Ptosis of the upper lid.* After an injury which has resulted in ptosis of the upper lid, four to eight months are usually allowed to elapse before reparative

surgery is undertaken, since partial and occasionally almost complete restoration of function may occur. Although the eye may possess normal vision, it will be



Fig. 8b (Kohout and Callahan). The support given the lid reduces the edema rapidly.



Fig. 10 (Kohout and Callahan). Ptosis of the lid from trauma. The upper lid is supported by this device during the period of possible recovery, giving binocular vision.



Fig. 11b (Kohout and Callahan). Extreme elevation of the normal eye and lids shows no elevation of the left upper lid. Fig. 11c, Insertion of especially designed plastic eye corrects ptosis.

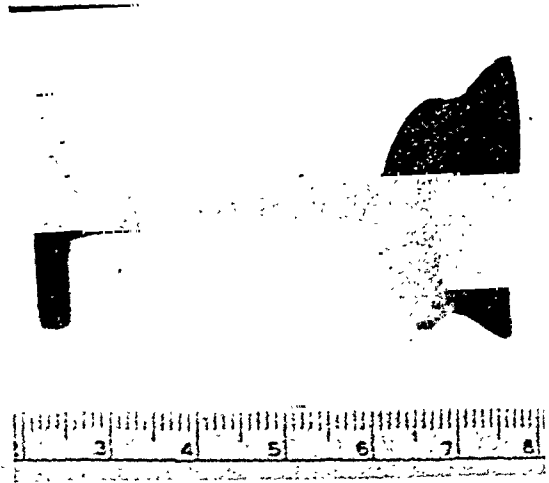


Fig. 9 (Kohout and Callahan). This device is inserted in the socket, and pressure is exerted by adhesive tape attached to the forehead and cheek over the bar.

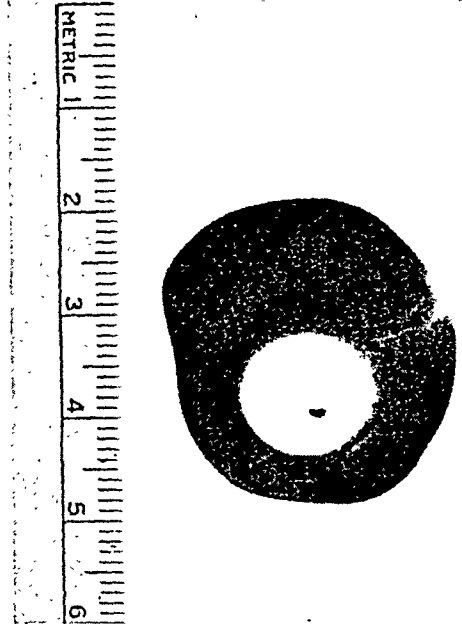


Fig. 11a (Kohout and Callahan). Plastic artificial eye with prominent superior ridge.

valueless during this time because of the ptosed lid. A device has been originated which permits binocular vision by elevating the lids during this period of observation (fig. 10). Even in cases wherein no restoration of function of the levator occurred, the local muscle tone may have improved.

6. *Ptosis of the upper lid with anophthalmos.* When there is no action of the levator palpebrae and the eyeball has been lost, it is often unnecessary to emplace a fascial sling or perform other types of repair for blepharoptosis. In our series, 12 of 16 cases have been satisfactorily corrected by the insertion of a plastic artificial eye made with a prominence on the upper border as shown (figs. 11a, b, c).

7. *Rapid settling of the socket.* In the process of making a plastic eye, one of the last steps in the procedure is the removal of the anterior "stem" from the center of the cornea. To hasten the seating of the artificial eye in certain sockets where it assumes an "exophthalmic position" a T-shaped pressure device has been made which may be slipped upon the stem. By using a strip of adhesive tape as a brace, this device shortens the time otherwise required for the final positioning of the eye (figs. 12a, b, c).

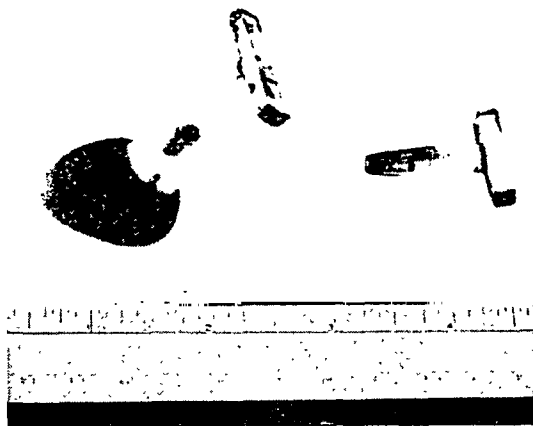


Fig. 12a (Kohout and Callahan). The T-shaped pressure device which may be slipped upon the "stem" of an artificial eye.

8. *Complete loss of eye, lids, and orbit.* Major surgery of the orbit and lids is required for the correction of this condition. Proper caution must be employed because of the proximity to meningeal and cerebral tissue. Even at best, a long period of hospitalization is required. Certain selected cases can be handled preferably by the use of an external prosthetic device combined with the usual spectacle frame (figs. 13a, b, c, d).

SUMMARY

1. Certain deformities of the eye and eyelids may be improved and corrected by ophthalmopedics. 2. The types de-



Fig. 12b (Kohout and Callahan). Very prominent artificial eye, due to abnormality of socket, with T-shaped device in place. Fig. 12c, Adhesive tape presses eye in for more rapid "seating." After approximately two weeks, the artificial eye remains in this position without the pressure appliance.



Fig. 13a (Kohout and Callahan). View of external prosthesis from the front. Fig. 13b, Lateral view of external prosthesis.

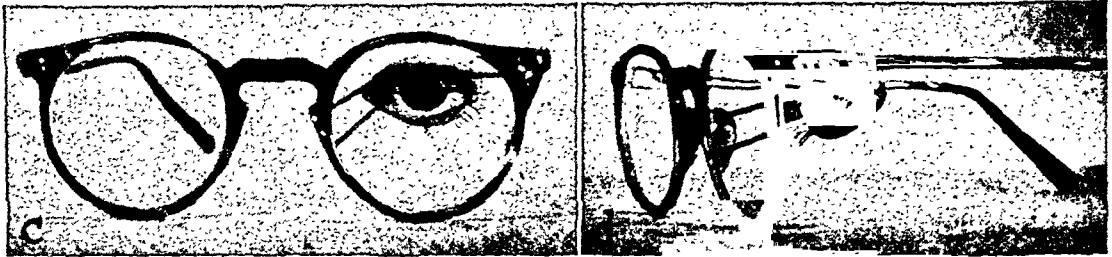


Fig. 13c (Kohout and Callahan). Detailed view of external prosthesis. Fig. 13d, Lateral view.

scribed are made of methyl methacrylate. 3. Each deformity requires individual consideration. 4. The use of ophthalmopedics in the following deformities is described: (a) Enucleation and evisceration; (b) contracted socket; (c) wrinkling of the skin in lid reconstruction; (d) edema of the lids; (e) ptosis of the upper lid; (f) ptosis of the upper lid with

anophthalmos; (g) as an aid in seating abnormally prominent artificial eyes; (h) complete loss of eye, lids, and orbit.

The authors are indebted to T/Sgt. Robert Shriver for the photographs which accompany this article.

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THE THERAPEUTIC TREATMENT OF UVEITIS ASSOCIATED WITH TOXOPLASMOSIS*

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The method of treating ocular disease associated with an apparent active infection of toxoplasmosis may be based primarily on the suppression or the elimination of toxoplasma in the body and secondarily upon the local manifestations of the disease. This paper is concerned with the general therapy of ocular toxoplasmosis.

A very few reports mentioning the use of drugs in cases of toxoplasmosis have been published. Sabin and Warren¹ have tested a series of drugs by experimental methods. Atabrine, trypaflavin, potassium antimonytartrate, rivanol lactate, optochin, mapharsen, neosalvarsan, tryparamide, and quinine hydrochloride killed toxoplasmas but had no therapeutic effect when used on infected animals. Fouadin, stibosan, silver salvarsan, bismuth subsalicylate, sodium aurothiomalate, sodium iodide, methylene blue, and Bayer 205 had no influence on the infection. Only the sulfa drugs had curative properties although they were harmless *in vitro*.² Sulfanilamide was only slightly beneficial. Sulfapyridine and sulfathiazole cured infected mice only when a high blood level of the drug was maintained. They arrested a severe infection in mice, but the immunity was not increased. In rabbits, the immunity was developed during the drug therapy, and the animals remained cured. Biocca and Pasquali³ confirmed the experience of Sabin with the therapy of the sulfa drugs on mice.

The action of sulfa drugs on patients has not yet been evaluated. Pinkerton and Henderson⁴ found that sulfanilamide

was ineffective in a fatal case of toxoplasmic encephalitis. Sabin⁵ tried the same drug on a child. Zuelzer⁶ used sulfadiazine and sulfamerazine in three cases. One child survived. The dosage was not reported. Cowen *et al.*⁷ gave sulfathiazole to one patient. In all of these cases the effect of sulfa drugs was unknown or not demonstrable. Vail *et al.*⁸ treated one patient twice with typhoid vaccine and with 15 grains of sulfathiazole every four hours for 37 doses. The uveitis became inactive. Later the uveitis reappeared, and the sulfathiazole therapy was repeated. When the ocular disease became worse, sodium iodide was given and the condition improved. A second patient was given typhoid vaccine and later tuberculin injections, without effect.

About 70 cases which have given positive intradermal protective tests for toxoplasmosis have been seen up to January 1, 1945, in the section of ophthalmology of the University of Chicago Clinics. Fifty of these cases have been studied with the purpose of evaluating the effects of various treatments. The results of the study are recorded in this paper. The clinical progress of each case was outlined to bring out any relationships which might exist between treatment and changes in the patient's condition. The evaluation of the results of the treatment were based on: (1) subjective impressions of the patient; (2) changes of vision; (3) state of activity of the disease as indicated by the amount of hemorrhage, exudate, and scarring; (4) change of the visual field. It was customary to give several patients a combination of medicines rather than one alone. In such cases, the results have been attributed

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equally to the members of the combination unless there was more favorable evidence for one drug in certain cases than in the other cases. Although some therapeutic measures were initiated at a time when the disease was regressing or quiescent, the results are not without significance since this disease appears to be one of constantly fluctuating activity. A drug would be of importance if it could prevent recurrence as well as halt progress.

Eighteen of these 50 cases received no treatment. Twelve of these 18 were inactive when first seen and remained so while followed. However, most of these cases were seen only once or twice over a one- or two-month period. Three of the 12 cases were seen over longer periods (6, 10, and 24 months). Five of these 18 cases showed some activity but received no general treatment. These five were seen over periods of two to seven months and only one of them showed any change in degree of activity.

Fourteen patients received typhoid-vaccine injections as fever therapy; eight received sulfonamides (that is, sulfanilamide, sulfadiazine, sulfapyridine, or sulfathiazole) at the same time, and one, para-amino-benzoic acid. In 8 of the 14, improvement was noted, either temporary or permanent, within four days to three weeks after treatment. Seven of these eight were patients who received sulfonamides (or para-amino-benzoic acid in one case) at the same time. The patient who was treated with sulfanilamide became worse. Of the five patients who received triple-typhoid-vaccine injections alone, four were apparently unaffected by treatment, one possibly was improved. In one case the eyes had grown worse three weeks following treatment, but since this change occurred such a long time later there would be little justification in attributing it to the treatment.

In the eight cases which improved fol-

lowing triple-typhoid-vaccine injections and (except in one case) administration of sulfonamides or para-amino-benzoic acid, the treatment appeared to be helpful. Furthermore, the combination of triple-typhoid vaccine and sulfonamide drugs appears to have been more beneficial than triple typhoid alone. The courses of typhoid-vaccine-fever therapy consisted of three to five injections, varying from 15 to 130 million units and given over a period of 7 to 14 days. The fever ranged from 102° to 104°F. by mouth. Those patients who received sulfonamides were given 4 to 7 gm. per day during the fever therapy. The para-amino-benzoic acid was given in 4- to 7-gm. doses on two days.

Two cases were treated with sulfathiazole and sulfamerazine. One case was in a state of regression, and the course remained unaltered with sulfamerazine. The other case was not benefited by sulfathiazole alone. About two months later the same patient received injections of triple-typhoid-vaccine shots and sulfadiazine, and his condition underwent a subsequent regression of activity. These data suggest that the combination of triple-typhoid vaccine and sulfonamide was more effective than sulfonamides alone. The sulfonamides were given in doses of around 3 gm. per day for two to three weeks.

In 5 of the 11 cases treated with atabrine and plasmochin there was inactivity, regressing activity, or little activity when treatment was started; in regard to these, it may be stated that there were no exacerbations during medication and that the drugs did no harm. Of the remaining six cases, five showed improvement from the drug. One outstanding feature of the last four of these cases was the marked subjective improvement following administration of the drug. There were also some objective signs of improvement.

Little may be said by way of comparison of the atabrine-plus-plasmochin combination and atabrine alone, for the former was used mainly in the treatment of inactive cases. Atabrine was administered as atabrine hydrochloride, 50 to 200 mg. per day for periods of 2 to 14 weeks; these periods were interspersed with periods of alternating therapy with plasmochin plasmoate, 20 mg. per day, by the week.

Ten cases were treated with potassium iodide. In one of these, there was evidence of improvement during the five weeks following treatment. However, the patient was receiving trythrityl tetranitrate at the same time. In another, the lesion showed progression three weeks after treatment was started. The question then arose whether or not the drug did any harm. However, since the drug had an indifferent effect in eight other cases, in six of which there were active lesions when medication was started, this seemed unlikely. Potassium iodide appeared to be ineffective.

Three cases treated with proteolac showed no effect from treatment, and three possibly benefited. However, the response of the last three was slow or minimal. This treatment may be said to have slight therapeutic possibilities. The proteolac was administered intramuscularly in doses of $1\frac{1}{2}$ to 2 c.c. every day or on alternate days for periods of 20 to 30 days.

Five cases, four of them active, were treated with quinine. No changes were noted following treatment. Quinine appears to be ineffective. The patients were given 5 to 20 gr. per day for two weeks to four months.

Erythrityl tetranitrate had no appar-

ent effect in three cases while three other cases showed questionable benefit. This drug appeared to be of little value in this treatment. It was given in 30- to 90-mg. doses per day for periods of five weeks to three years.

Old tuberculin was used in two cases of chronic choroiditis and one of chronic iridocyclitis without any good evidence of improvement. The treatment was given over a period of about six months and comprised around 25 injections of increasing strength from 0.05 c.c. of 1:10,000 to 1.8 c.c. of 1:1,000 dilution.

Various other therapeutic treatments were tried. Brewer's yeast appeared to have been of questionable benefit in a case showing a fairly typical picture of the disease. In one case X-ray treatment seemed to stop recurrent bleeding into the vitreous humor. Calcium lactate, Fowler's solution, citrus-fruit juices, nicotinamide, nicotinic acid, thionine chloride, vitamin-B complex, papaverine hydrochloride, and sodium nitrite induced no improvement. One million units of penicillin given in doses of 100,000 units every three hours for two days proved valueless.

CONCLUSIONS

At the present time the presumptive evidence is that the sulfonamides—sulfadiazine, sulfapyridine and sulfathiazole—with typhoid-fever therapy may have value in the treatment of uveitis associated with toxoplasmosis. Sulfonamides alone seem to have little or no effect on the disease. Atabrine apparently gives some subjective and objective improvement. Penicillin, vitamins, potassium iodide, and vasodilators produced no demonstrable change in the course of the disease.

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EXOPHTHALMOS CAUSED BY EOSINOPHILIC GRANULOMA OF BONE*

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Eosinophilic granuloma of bone is a relatively new disease entity. A few isolated reports of cases showing similar pathologic change appeared in the literature between 1929 and 1938 (Frinzi, Mignon, Fraser, Schairer) but it was not until 1940 that articles were published which recognized the clinical and histologic picture as a distinct entity. In that year Otani and Ehrlich gave it the name of "solitary granuloma of bone," while at the same time, and independently, Jaffe and Lichtenstein used the name "eosinophilic granuloma of bone" which they considered more descriptive. This latter name has been quite generally accepted by subsequent writers. At least 37 cases have now been reported.

The clinical features of eosinophilic granuloma are a rapidly developing painful swelling over the skull, a rib, or a long

bone, in a child or young adult. In many cases multiple lesions have been found by the X-ray, but in practically every instance there was only one that gave symptoms. Lesions have been found in the frontal bone in at least seven instances but in only one case, a girl of four years (Gross and Jacox), has exophthalmos been reported. The diagnosis is made by histologic examination, for there is nothing distinctive about the X-ray findings. The pathologic picture is unmistakable and will be described in the following case report.

REPORT OF CASE

A young man, aged 34 years, was seen for the first time on August 23, 1944. His right upper lid had begun to swell five weeks previously. He then developed pain behind the eye. The swelling varied; the vision was blurred when the swelling was marked.

Examination. Vision was 20/15 in each eye. The muscle balance was normal. There was an exophthalmos of the right

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eye of 2 mm., the globe being displaced downward about 4 mm., but without limitation of motility. No mass was palpated. The fundi were normal. No enlarged lymph nodes were found.

X-ray report. Dr. Pfeiffer reported the orbital X-ray studies (fig. 1) as follows: "The right orbit shows a fairly circular defect through the roof, measuring approximately 2.5 cm. posterior to the outer half of the upper margin. The margins of this defect are slightly irregular and show no tendency to increased density of the bone. The defect extends upward perhaps a centimeter and appears to be covered throughout by the inner table, although this cannot be stated with certainty. The defect is cystic in appearance and does not communicate with any of the paranasal sinuses; it is more suggestive of an epidermoid than of anything else, although the margins of the defect are not sharp and do not show increase in bone density."

Operation. On the following day, the right orbit was entered through a lateral canthotomy. In retrospect, it is realized that it would have been better to approach the tumor through an incision below the lateral third of the brow. The tumor was located, after considerable difficulty, in the region of the lacrimal gland. It was a flattened, firm swelling lying above the lacrimal gland and extending back about 3 cm. into the orbit, along its superolateral wall. No definite capsule was encountered, but when the mass was opened a soft, pinkish-cream-colored material presented. At first this looked like the sebaceous material found in a dermoid cyst; further exploration, however, showed that it was not cheesy but rather very soft, partly necrotic,

granulation tissue. It was too soft to remove with any instrument other than a large curette used as a spoon. Throughout the mass were many small spicules of bone, and the bony wall was extremely irregular. Because of the poor exposure afforded by the small incision, the exact size of the mass could not be determined,



Fig. 1 (Wheeler). X ray of the orbits, before operation, showing the large defect in the roof of the right orbit.

but the cavity was thoroughly curetted. The incision was closed tightly, an intermarginal suture placed, and a firm pressure-dressing applied.

Postoperative course. The patient's recovery was uneventful until the preauricular lymph node became enlarged, about 10 days after the operation. This caused some uneasiness on the part of both the patient and the doctor, but it gradually subsided and now, nine months after the operation, there is no evidence of recurrence, although there is still about 1 mm. of exophthalmos. X-ray studies at this time show: "the inferior portion of the lesion of the roof of the orbit to be healed with the defect largely filled in." X-ray films of the skeleton failed to show any other lesions.

Pathologic examination. The specimens were composed largely of necrotic granulation tissue (fig. 2) containing large numbers of histiocytes, many of which showed evidence of phagocytic activity and occasional large multinuclear giant

The youngest was 2 years old. Thus it is a disease of children and young adults.

Diagnosis. Because of the tumor's rapid growth and the X-ray picture of a localized lesion starting in the medullary cavity and tending to erode, expand, and perforate, a malignancy is frequently suspected. The X-ray appearance must be differentiated from primary carcinoma, bone cyst or osteomyelitis, multiple myeloma, Ewing's tumor or a metastatic tumor, and now, for the first time, from an epidermoid. The final diagnosis must be made by histologic study, and in this case probably an aspiration biopsy would have sufficed. The characteristics have been described and are quite distinctive.

Etiology. Attention should be called to the theory of Farber that eosinophilic granuloma, Hand-Schüller-Christian disease, and Letterer-Siwe's disease represent different stages in the same basic disease process. This has been ably set forth by Mallory. Letterer-Siwe's disease (aleukemic reticulosis or nonlipoid histiocytosis) always occurs under two years of age and is rapidly fatal. It is char-

acterized by marked proliferation of the reticulo-endothelial cells, particularly in the skin, lymph nodes, and spleen. Hand-Schüller-Christian disease, characterized by multiple defects in the cranial bones, exophthalmos, and diabetes insipidus, occurs a little later in life and is less malignant in its course. The pathologic picture is that of a granulomatous process accompanied by significant grades of inflammatory reaction, both leucocytic and fibrotic. Eosinophilic granuloma of bone

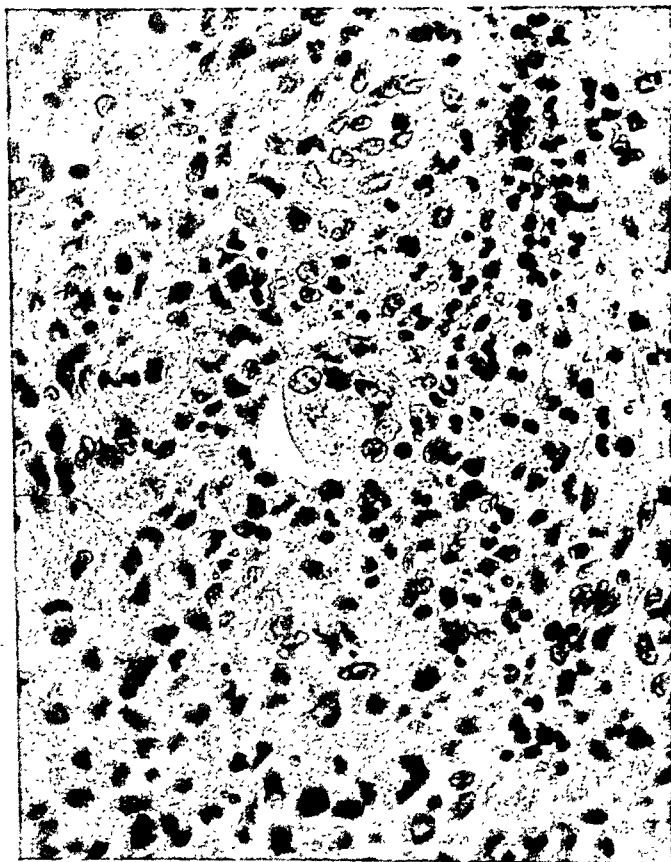


Fig. 2 (Wheeler). High-power photomicrograph, showing large multinuclear giant-cell and numerous histiocytes, some in various stages of necrosis.

cells. There were also numerous eosinophilic and neutrophilic leucocytes and many clumps of mononuclear cells taking an eosinophilic stain. Occasional bits of bone were found.

DISCUSSION

Age. Only two cases have been reported in which the patients were older than the man described here (Otani and Ehrlich, 35; Versiani and Figueiro, 50).

appears at a still later age and is much milder in its manifestations. Farber found every grade of transition from the typical Hand-Schüller-Christian disease to eosinophilic granuloma. Otani and Ehrlich tried to establish the relation between eosinophilic granuloma and trauma. Jaffe and Lichtenstein, who are in accord with Farber and Mallory, believe that the basic anatomic disorder in these three conditions is a peculiar inflammatory histiocytosis, possibly caused by a filterable virus.

Treatment. Because of the uncertainty as to the etiology of these lesions and the strong clinical suggestion of malignancy, they have been treated in various ways: by wide excision or by curettage, both

with and without X-ray therapy; and by the X ray alone. Apparently all the patients have recovered.

CONCLUSION

A case of eosinophilic granuloma of bone, in which unilateral exophthalmos was the presenting symptom, is described, with a brief discussion of the salient features of this relatively new entity.

The author wishes to express his gratitude to Dr. William L. Gills for kindly permitting him to present this case, to Dr. Raymond L. Pfeiffer for his interpretation of the X-ray studies, and to Dr. Algernon B. Reese for his aid in the pathologic study.

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PLASTIC-ARTIFICIAL-EYE PROGRAM, U. S. ARMY

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There is little doubt but that creative thought arising from military exigency has made important contributions to the progress of medical sciences in the recent conflict. The many accomplishments of all branches of the Medical Department of World War II speak for themselves. The ingenuity and diligence of both military and civilian personnel in wartime service in the face of tremendous odds merit commendation.

The task of rehabilitating our fighting men to more peaceful pursuits is beginning to draw to an end. With the proof of many hypotheses before us, it is now possible to assume a more objective viewpoint of what actually has been accomplished during the past few years.

In this connection, it is interesting to observe how one problem, the supply of artificial eyes to military patients, was

faced by the U. S. Army Medical Department.

HISTORICAL BACKGROUND AND PROBLEM

The world's supply of glass artificial eyes, particularly the iridial portions thereof, was, and still is, controlled for the most part by the members of one German cartel. Formulas for the special type of glass required, and details of the technique employed in the manufacture of the iris component are not generally known, although at least one American glass manufacturer has been at work for some time on the problem of developing an adequate substitute.

With the advent of World War II, German exports to the United States and allied countries were brought to a sudden halt. True, a few stock glass eyes and irides found their way into this country, but the supply was far from adequate in meeting even civilian demands, let alone those of the military. The critical nature of this emergency was further aggravated by three factors: First, glass eyes require frequent replacement because of break-

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age, surface etching, and discoloration. Second, the anophthalmic socket and adjacent structures will not wait long for reception of prosthesis without changing size, shape, and tonicity. Unless a suitable restoration is placed within a reasonable length of time, the percentage of cosmetically acceptable prostheses is considerably reduced. Third, the average stock glass eye is not adequate for use in cases of military nature where lacerated, lost, or crushed tissues have required extensive surgical repair.

For these reasons, the few glass-eye makers in America capable of making custom-built prostheses were faced with the impossible situation of supplying the demands of the military as well as caring for the needs of their civilian clientele. Likewise, stocks of glass artificial eyes rapidly dwindled to the point where only a few utilizable prostheses remained.

It was not long before patients in military hospitals in the United States and overseas were constituting a considerable backlog because of the unavailability of a satisfactory supply of artificial eyes. In desperation, odd sizes, shapes, and colors of stock eyes were inserted in patients for whom custom-made prostheses were obviously indicated. Embarrassment and deterioration of patient morale resulted. Much dissatisfaction was registered.

As has been mentioned, similar situations existed in allied countries. Shortly after the onset of the war, when it was apparent that supply would not meet demand, the British established a school for women in this field. In spite of the excellent job done under the existing conditions, lack of special glass and technical "know how" left something to be desired. The Russians, too, were having their difficulties and were reputed to have resorted to the use of eye patches with the intention of placing restorations at

such time as an adequate supply of artificial eyes might be forthcoming.

It is obvious, then, that a large number of restorations was urgently required by the Medical Services of all allied countries. This was imperative not only for the reason of preventing total depletion of the civilian supply but also to fit patients who were already hospitalized. Still more important, it was necessary to prepare for demands of the days yet to come.

A number of requirements had to be satisfied in this connection. Restorations of a more durable substance than glass were desirable. The prostheses would have to be as natural or more natural in appearance than those of glass. A material had to be used which could be produced easily and which would lend itself readily enough to routine technical procedures, necessitating only a minimum of technical skill and laboratory equipment. A rapid teachable method had to be devised which could be standardized to the point where component parts of the prosthesis might be prefabricated, then assembled, modified, and adjusted to meet the patient's individual requirements. These requisites were of paramount importance in the military service during the recent emergency.

TRAINING OF ARMY PERSONNEL

In answer to the challenge existing in the European Theater of Operations in the early days of the war, one of us (S. F. E.) began to adapt dental materials and technique to satisfy the requirements mentioned. Although this initially designed plastic eye, with its hand-cut iris recess and scribed and painted veins, was somewhat crude, judged by present Army standards, the results were satisfactory considering the necessarily improvised equipment used at that time.

On the basis of this early work, and through the foresight of Maj. Gen. P. R. Hawley, then Chief Surgeon, E.T.O., Dr. Derrick T. Vail, then Colonel (MC), Senior Consultant in Ophthalmology for the European Theater of Operations, Col. William D. White, then Chief Dental Surgeon, European Theater of Operations, and Col. D. H. M. Stanley (MC), then Commanding Officer of the 30th General Hospital, a training center for ophthalmoprosthetists was organized in England, in December, 1943. A technical manual¹ for student use was written at that time, and 40 dental officers from U.S. Army General Hospitals were selected for training. The British War Department also assigned 10 dental officers of the British Army, Royal Navy, and Royal Air Force for training in the technique.

In the meantime, the situation with regard to the supply of artificial eyes to Army personnel still persisted in the United States, although mitigated to a considerable extent by the efforts of two of us (V. H. D. and M. S. W.). At Thomas M. England General Hospital in Atlantic City, New Jersey, and Camp Crowder, Missouri, respectively, these men were also at work on the problem of developing an adequate substitute for glass artificial eyes.

Realizing that the combined efforts of the authors would expedite the development of a standardized Army technique, Major General Norman T. Kirk, the Surgeon General, placed the overseas school in charge of Colonel Lynn C. Dirksen, Dental Corps, and brought the authors together under the administration of Mr. Stanley W. Rybak, Supply Division of The Surgeon General's Office. It was felt at this time that the program would function more advantageously if placed in closer liaison with the Medical Department activity which it was to serve. For this reason, executive policies

were established by such men as Lt. Col. M. E. Randolph, Col. Derrick T. Vail, and Major Trygve Gundersen, all of the Office of Ophthalmology, Surgeon General's Office, U. S. Army. Research by the authors was intensified under this organization. The desirable features of three respective techniques were combined and improved features added.

In September, 1944, a second technical manual² for student use was written, and a 30-day course of training conducted for 12 dental officers. Upon termination of the training period, these men and their instructors were assigned to various general hospitals throughout the country and overseas. They, in turn, trained other officers and technicians. Supervision of these installations and conferences concerning policies were regularly conducted. One year later, in October, 1945, 30 installations had inserted over 7,500 all-plastic artificial prostheses for patients, many of whom would otherwise have been forced to accept inadequate glass eyes. This figure is in addition to those restorations made by the initial trainees still operating in the European Theater of Operations.

The various installations are now in the process of being demobilized, as military demand for artificial eyes decreases. Attention is at present being directed toward the organization of a program and training of personnel for the Veterans Administration.

Due credit must be given the excellent work of the Navy in development of acrylic eye prostheses for their branch of the service.^{3, 4, 5}

JUSTIFICATION FOR SELECTION OF DENTAL PERSONNEL

In any military emergency, speed is an important factor in returning hospitalized men to duty. Since the particular technique employed in fabricating eyes

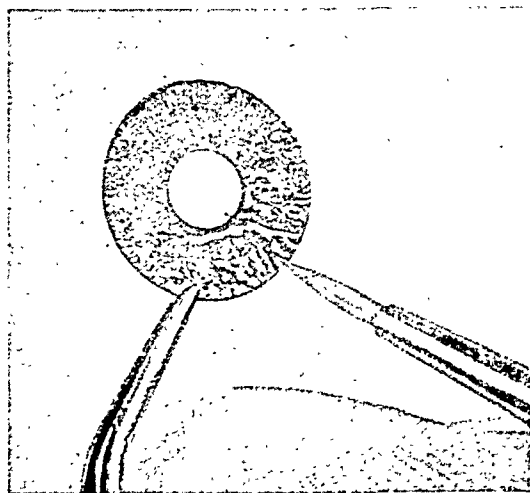
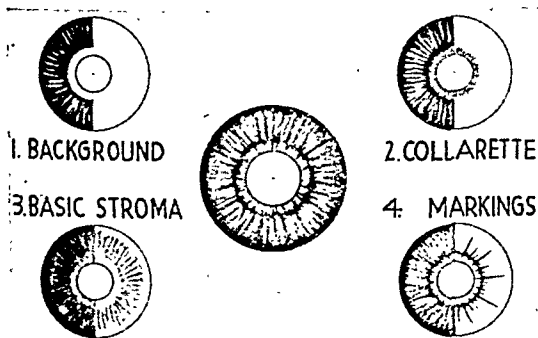
was one which could be rapidly mastered by individuals familiar with dental procedures, dental officers and technicians were selected. In actuality, little more instruction was required beyond the giving of a few measurements and technical shortcuts. With the streamlined teaching method employed, the trainee was familiarized in short order with the oil painting, impression taking, mold construction, compounding and processing of plastics, and fitting as applied to plastic-artificial-eye construction. After two weeks of instruction, the average dental officer with previous specialized experi-

to compensate for socket irregularity so frequently observed in cases of military nature.

3. Adaptability of various other features, such as the corneoscleral junction, depth of anterior chamber, diameter of iris, pupillary aperture, vascularity, and sclera color, to meet individual esthetic requirements. This is possible only because of the strictly anatomic assembly of parts throughout.

4. An actual three-dimensional effect in iris construction due to suspension in clear resin of a perforated transparent disc which has been painted on both sides.

Fig. 1 (Erpf, Wirtz, and Dietz). The iris disc.



ence in dental prosthesis, was capable of fabricating acceptable eye prostheses. It may be mentioned that some ophthalmologists showing interest in this field have demonstrated their ability to perform the various technical procedures involved.

THE TECHNIQUE

The technique produces plastic artificial eyes^{6, 7, 8} incorporating the following advantages:

1. Freedom from fragility and surface etching occurring as a result of dissolution by socket secretions.

2. Adjustability of size and form during and following fabrication in order

The three-dimensional effect mentioned is further enhanced by placement of a jet-black pupil disc at some distance posterior to the iris disc.

5. Opportunity to stock prefabricated iris buttons, enabling the operator to know at the outset the exact color of the iris in the completed prosthesis.

6. Elimination of such time-consuming steps as multiple-mold construction, precision grinding of the iris recess, and engraving for simulation of veins as required in plastic prostheses of the conventional type.

7. Teachability of method in so far as dental personnel may be trained to under-

take all phases of fabrication after a relatively short period of instruction.

The technique of fabrication is divided into eight steps. Briefly described, they are as follows:

1. *The iris disc.* Perforated transparent discs of ethyl cellulose are used to represent the iris and pupillary aperture. Ord-

inal part is possible. The button can be made ready for immediate selection and use in the wax form on presentation of the patient. In spite of its simplicity, it embodies such important features as the following:

(a) A predetermined average corneal curvature and depth of anterior chamber

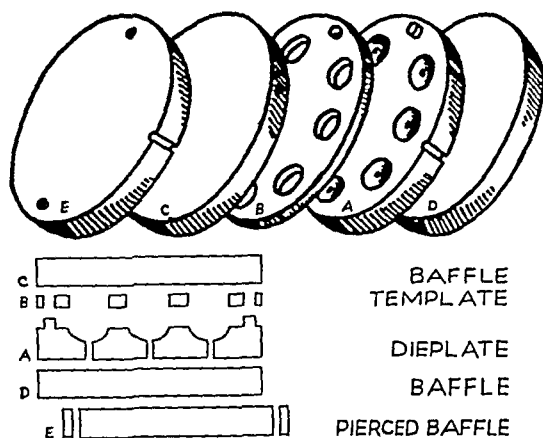
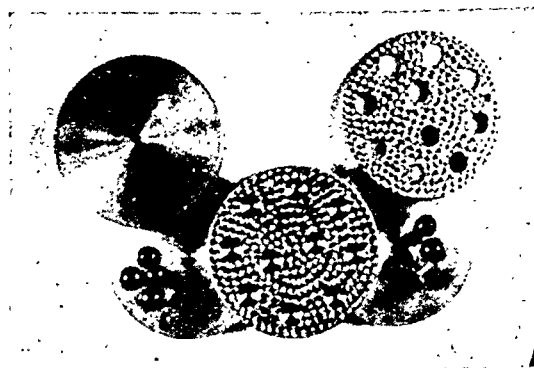


Fig. 2 (Erpf, Wirtz, and Dietz). The die set.



nary artist's oil pigments selected for high quality and color permanency are applied on both sides of the transparent disc. This procedure is accomplished in such a manner that the background and collarette colors on the underside will be clearly discernible through the striations of the stroma color and markings painted on the obverse (fig. 1). This feature produces a true third-dimensional effect in the subsequent processing of the iris button.

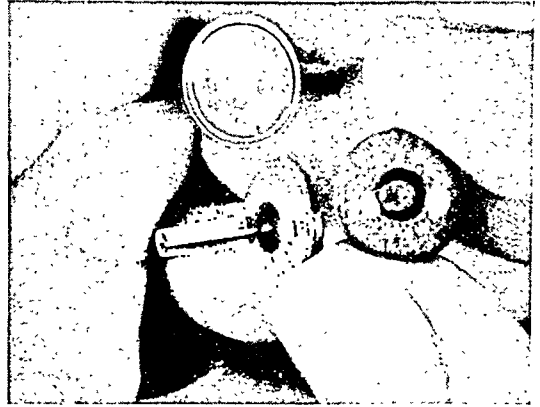
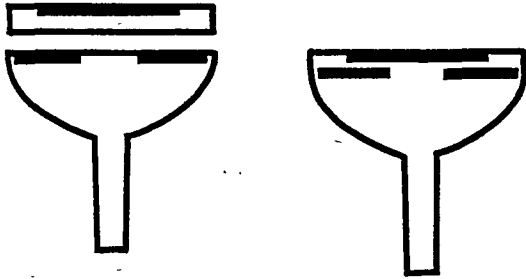
2. *The iris button.* The stainless-steel die-set (fig. 2) contains sectional cavities which permit the processing of iris buttons of various sizes in plastic. The iris button comprised four essential features; namely, the painted iris disc, the jet-black pupil disc which is immediately behind the iris disc, the clear portion representing the anterior chamber and cornea, and the button stem.

The advantages of the button *per se* are obvious in that prefabrication of an es-

which can be subsequently adjusted to meet individual requirements. (b) A means of producing the all-important diffuse junction between the cornea and sclera and the opportunity of adjusting it to meet individual requirements. (c) A means of accurately selecting an iris of proper size and color without making allowance for the magnifying and intensifying effect of a subsequently placed clear plastic overlay (fig. 3).

3. *The impression technique.* Two alternate impression techniques are employed in developing a wax form which will determine the size and shape of the scleral portion of the artificial eye. The first, the simpler and more rapid of these, is a "compression-impression technique" which is indicated in all cases where the socket to be fitted is not of grossly abnormal configuration, such as might be caused by cicatrices, extensive loss of contents of the socket, or injury to the

Fig. 3 (Erpf, Wirtz, and Dietz). The iris button.



structures of the eyelids (fig. 4). The second method is termed the "injection-impression technique. It is more circuitous in nature and produces a no more effectively shaped prosthesis for the uncomplicated socket. It is advantageous, however, in those cases of extreme irregularity where retention of an adequate prosthesis constitutes a problem (fig. 5).

When the wax pattern obtained by the method of choice has been trimmed to the proper shape and size as indicated by anatomic and cosmetic requirements, the position of the iris button is marked. A circular recess is cut into the wax at this point and the iris button luted into place. The wax pattern is then tried in the socket, and such corrections are made as may be necessary to bring the iris into

final position and alignment. It is obvious that standard-shaped blanks of wax, placed in stock ready for reception of the iris button and refinement of fitting, may be employed to facilitate this step of the procedure.

4. *The mold.* A mold in two halves is then made of the wax pattern with its iris button. Upon separation, the wax and button are removed and the surfaces of the mold tin-foiled. The iris button is reinserted and the mold is ready for the packing and curing of the plastic which represents the sclera.

5. *The sclera.* The sclera plastic is a carefully blended mixture of finely ground, transparent methyl methacrylate

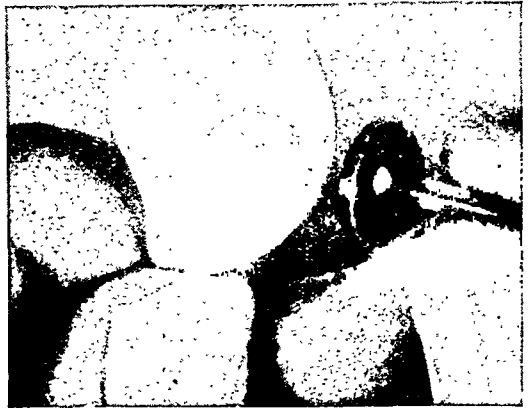
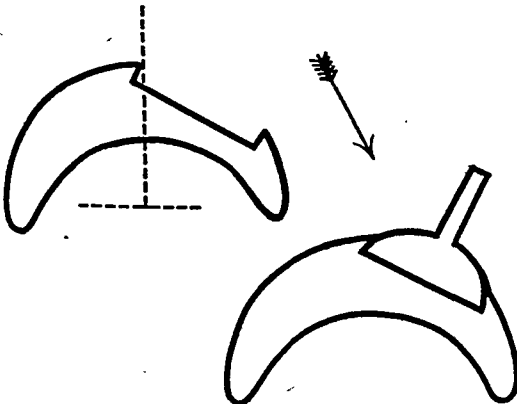


Fig. 4 (Erpf, Wirtz, and Dietz). The wax pattern.

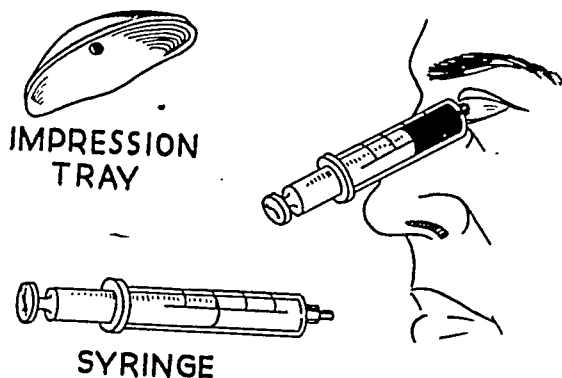


Fig. 5 (Erpf, Wirtz, and Dietz). The injection impression.

with suitable opacifying agents and pigments. Several shades of sclera plastic are necessary to meet individual variations.

Assuming that the scleral portion has been processed around the iris button, the button stem is removed and the prosthesis is polished, care being taken to establish a proper blend at the corneoscleral junction. Provision for the simulation of an anatomically correct corneoscleral junction is one of the advantages of the technique described and is not ordinarily observed in all-plastic restorations of the more conventional types.

6. *The veining technique.* Red rayon threads are employed for this purpose

(fig. 6). The separated monofilaments are tacked in place with an alcohol-chloroform mixture. Very realistic ramifications are attained by adroit application. In order to effect the structureless and delicate capillary beds, red oil pigments are delicately and sparingly applied. Similarly, oil colors of appropriate shade may be applied to simulate the characteristic surface pigmentations found in the visible areas of the sclera. Pingueculae are reproduced if desired and also the reddish tinge found in the region of the nasal canthus where the margin on the prosthesis might be visible during extreme lateral excursions. The restoration is now ready for application of the clear layer which will represent the conjunctiva.

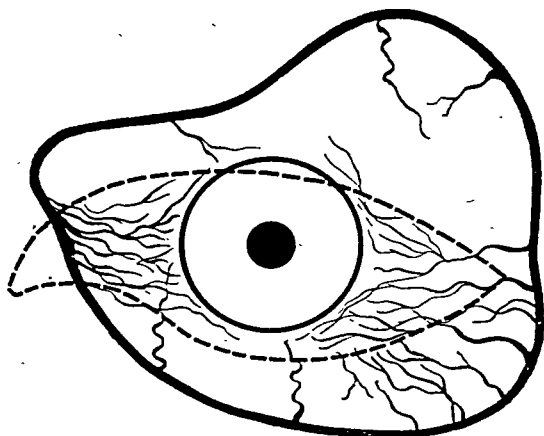
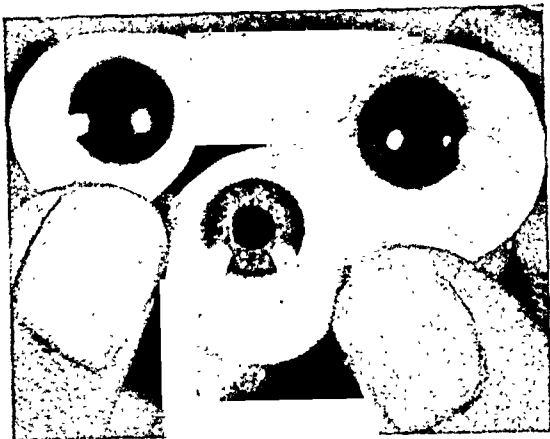


Fig. 6 (Erpf, Wirtz, and Dietz). The blood vessels of the sclera.

Fig. 7 (Erpf, Wirtz, and Dietz).
The finished prosthesis.



7. *Polishing and Fitting.* A final scratch-free polish is effected with suitable abrasive and buffing agents (fig. 7). The prosthesis, if carefully made, requires only minor adjustment upon insertion. Attention should be directed toward obtaining exact paralax. The contours of the cornea must be shaped to reflect high lights of identical number, size, and shape when compared to those of the eye on the

inspection reveal sockets that are clean and with good tissue tonus. Although this practice is not recommended, it is felt that it speaks well for factors of comfort and compatibility of synthetic resin in contact with tissue over long periods of time.

SUMMARY

The technique of fabricating plastic ar-



Fig. 8 (Erpf, Wirtz, and Dietz). Patient before and after insertion of prosthesis, Dibble General Hospital.

other side. This latter is extremely important, and the cosmetic success of the restoration greatly depends upon it.

The prosthesis is inserted (fig. 8) with a drop of mineral oil, and final instructions are given to the patient concerning proper care. Reference of the patient to the ophthalmologist is also desirable at this time.

It has been noted that many patients will wear prostheses for several weeks or months at a time without removal. Such well-fitted restorations when removed for

tificial eyes herewith described has satisfied the foregoing requirements. Its advantages are concerned principally with the inherent durability of the material used and the ease with which an optimum result may be realized. The method has been kept as simple as possible in order that no extraordinary artistic talent or technical skill would be required. The procedures involved are well within the capabilities of the average dental technician.

The design of the prosthesis is such

that it will permit fabrication in custom fashion with little more in the way of material and supply than those found in any prosthetic laboratory. The advantages of this feature, as, for instance, in a theater of operations, are obvious. On the other hand, where more elaborate facilities are available, stock production may be accomplished, if desired, without difficulty.

The basic synthetic resin, methylmethacrylate, is easily obtained, being a standard item used in the production of dental prostheses. It lends itself well to molding, coloring, and adjustment of size and shape after initial completion. Synthetic resin satisfies well the three factors important to the success of any prosthesis; namely, function, esthetics, and comfort.

CONCLUSION

1. A critical shortage of artificial eyes

developed as the result of wartime restrictions on imports of stock glass eyes and irides from Germany.

2. Military patients requiring artificial eyes were constituting a problem in hospitals in the United States and overseas because of this shortage.

3. A readily teachable technique was urgently required which would produce artificial eyes equal or superior to those made of glass.

4. An Army school for ophthalmoprosthetic technicians was established in the European Theater of Operations in 1943. This was followed by collaboration, intensification of research, and the organization of a second Army school in the United States.

5. By October, 1945, 30 Army installations had fabricated over 7,500 all-plastic artificial eyes in addition to those made by those installations originally established overseas.

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METHACRYLIC RESIN IMPLANT FOR SUNKEN UPPER LID FOLLOWING ENUCLEATION*

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The program of plastic-artificial-eye fabrication in the Armed Forces of the United States has directed attention forcefully toward the problems of cosmetic defects after enucleation.

The most common defect that makes fitting a satisfactory prosthesis difficult is a sinking of the upper lid following enucleation. Attempts to use a larger prosthesis or to build up the prosthesis with a ridge on its anterior-superior face fail to achieve a satisfactory cosmetic result because they serve only to widen the palpebral fissure. This causes a staring expression and makes proper lid closure difficult. The implantation of fascia lata has thus far been the only satisfactory method of filling up the defect. The method has recently been greatly improved by Cutler.¹ However, this method requires a period of hospitalization for healing of the donor site. In addition, some fibrosis of the fascia takes place, with adhesions between itself and the orbicularis muscle and orbital septum between which it is placed. Removal, if required for any reason, is difficult, especially if the fascia was inserted some time previously. A more satisfactory method of correcting this defect was therefore sought. The criteria for such a method were considered to be: (1) satisfactory cosmetic improvement; (2) simplicity of technique; (3) a mini-

mal period of hospitalization; (4) a minimal period of postoperative reaction and interference with fabrication of the prosthesis.

These criteria were fulfilled by two methods, the first of which was discontinued in favor of the second after the results had been observed in three patients. Since this earlier procedure gave some insight into the cause of the sinking of the lid, it will be briefly described. It was observed that, especially in the extreme instances, the central portion of the depression of the upper lid with the palpebral fissure fully open had the most marked cosmetic defect. Since the level of this depression was behind the plane of the attachments of the orbicularis muscle, it could not be explained by contracture of this muscle. However, the backward pull of the levator, together with the absence of support for the upper portion of the upper lid, could account entirely for the sinking. It was assumed that, if a strip of orbicularis in the region of the sunken area were made taut, the depth of the depression could be decreased to the plane of the orbicularis attachments.

In each case an incision 24 mm. long was made in the skin of the upper lid in the superior orbito-palpebral sulcus. The skin was undermined in the portion above the incision to expose the orbicularis for a width of about 10 mm. The orbicularis was then split at the level of the skin incision and undermined upward. It was split again to form a band 5 mm. wide. This strip was cut at its center, and the

* From the Eye Department, Barnes General Hospital, U. S. Army, and the University of Illinois Medical School. Continuation of this study under a grant from the W. K. Kellogg Foundation.

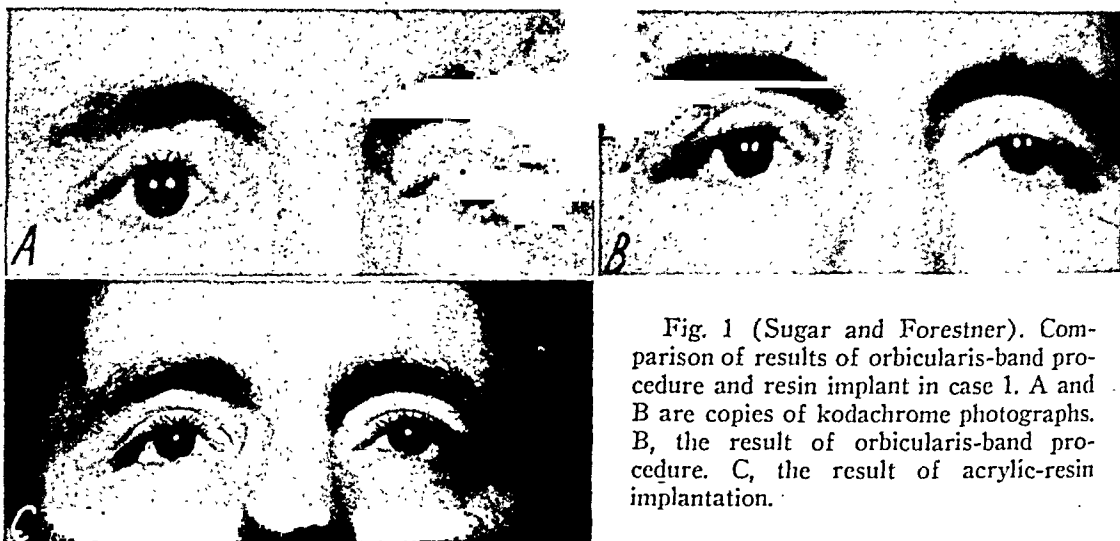


Fig. 1 (Sugar and Forestner). Comparison of results of orbicularis-band procedure and resin implant in case 1. A and B are copies of kodachrome photographs. B, the result of orbicularis-band procedure. C, the result of acrylic-resin implantation.

ends overlapped and sutured together to form a taut band. The split edges of the orbicularis were sutured together anterior to this strip. The skin was sutured subcuticularly with silk and a pressure bandage applied. In two of the three cases, the operation was performed on an out-patient basis, each of the two patients being off duty for 24 hours. The procedure was successful in decreasing the depth of the sulcus (fig. 1, case 1) but did not fill out the upper lid adequately. It then occurred to one of us (H. S. S.) that an implant of methyl methacrylate of proper shape could easily be fashioned and inserted underneath the orbicularis in the sunken lid. Impressions of both upper lids and brows were made on four patients with sunken upper lids after enucleation. The impressions were cast in stone, and a wax form was made to fill in the difference between the two. The form was cut off at the level of the superior orbitopalpebral sulcus so that the implant would not interfere with the function of the levator. The wax forms were found to be similar in each case. Plaster molds were then made from them.

The implants were made by combining one part of the liquid monomer form with three parts of the solid polymer

form of methyl methacrylate* to form a soft dough. Some of the implants were cured by placing the dough in the plaster molds at a temperature of 80°C. in a

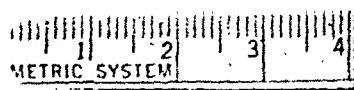


Fig. 2 (Sugar and Forestner). Photograph of back and front surfaces of implant.

press clamp producing 300 to 400 pounds of pressure per square inch, for 16 to 18

* Acralain acrylic no. 93 was the commercial substance used.

hours. The remaining implants were cured in boiling water for 1½ to 2 hours under the same conditions of pressure as the other implants. The finished solid products were then smoothed and polished (fig. 2). Because of slight variations in the size of the orbit in different individuals, the implants were made in varying sizes, 27 to 30 mm. in length and usually 5 to 8 mm. wide at the center. With several sizes of implant, each new

from pneumonia or were accidentally killed, none of the 31 remaining animals showed any abnormalities on gross necropsy examination at the end of the experimental period. The powder was found adherent either to the skin or abdominal wall, in a thinly encapsulated mass. No signs of irritation were present, nor were there abdominal adhesions in the animals subjected to the intraperitoneal administration.

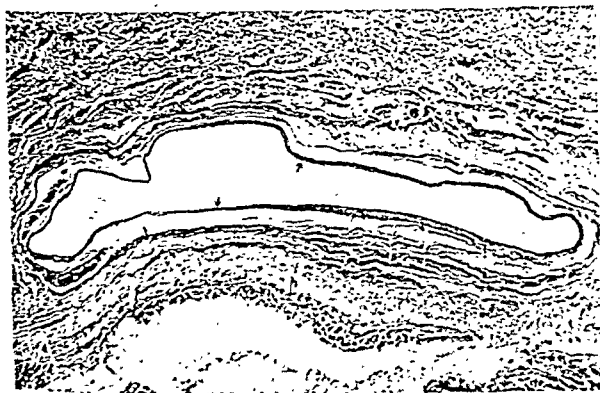
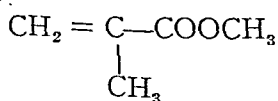


Fig. 3 (Sugar and Forestner). Photomicrograph of eyelid of rabbit one month after implantation of methyl methacrylate. Arrows point to capsule surrounding space previously filled by implant. A, low power. B, high power.

patient could easily be fitted from the supply at hand. When necessary, they could be easily ground down to smaller size.

The tolerance of tissues toward methyl methacrylate has been the object of some investigation. The substance has the following chemical formula:



According to the findings in experiments by Haag² in 1939-40, the solid polymeric form of methyl methacrylate has no toxic effect on tissues. Haag placed fine granules of two commercial preparations of pigmented methyl-methacrylate polymer either subcutaneously or intraperitoneally in gelatin capsules in 60 mice. These were left for nine months. Although a number of animals were lost

The liquid monomer form of methyl methacrylate, unlike the polymer, has been found to be toxic in about the same order of toxicity as is acetone.² However, during the process of polymerization or curing, the monomer is changed to the polymeric form. In order to ensure using the most stable and fully cured resin, the curing process should take place at the temperature of boiling water, since physical studies by the manufacturers^{2a} indicate that the polymer is most stable and fully formed when cured at temperatures from approximately 210° to 240°F.

It is best to avoid using those preparations of methyl methacrylate which contain a plasticizer, since such resins are not so resistant to chemical change as is pure methyl methacrylate polymer.

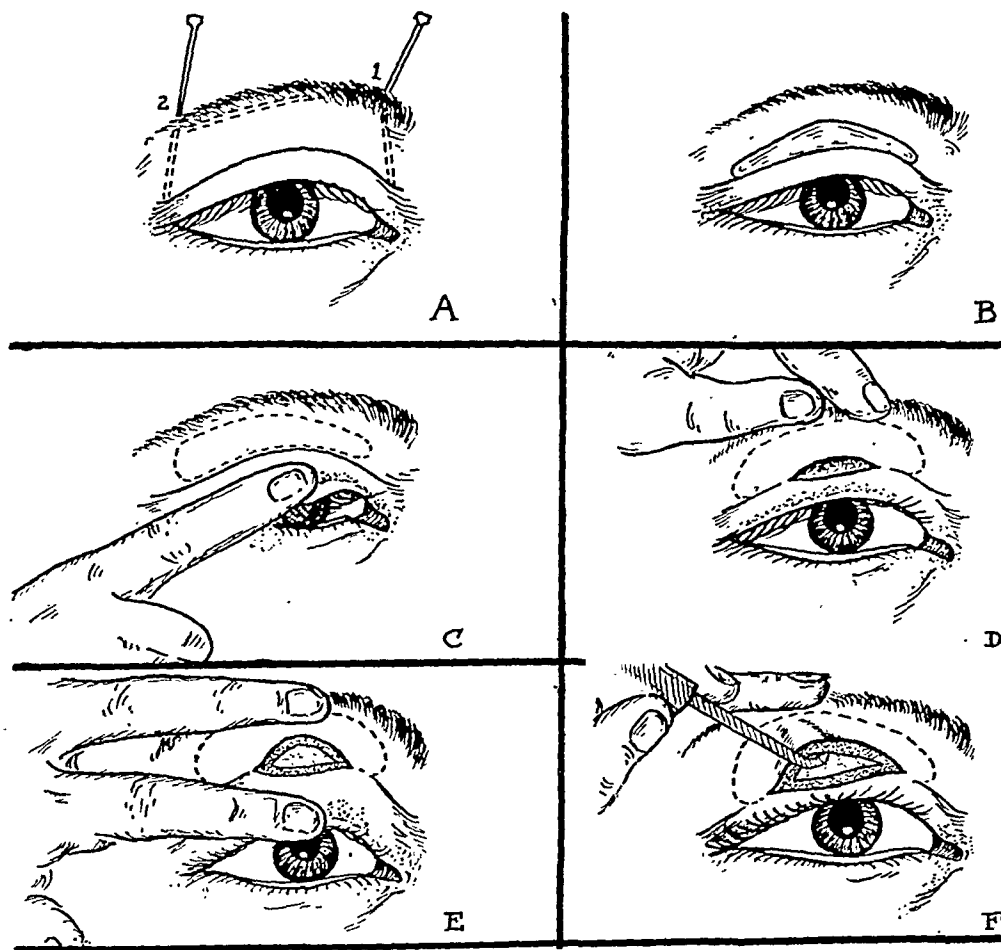
The polymerized methyl-methacrylate resin is slowly soluble in esters and ke-

tones but is insoluble in water and alcohol. Because of its solubility in ketones, surgeons have been cautioned against the use of such an implant in cases of diabetes.³

Acrylic resins have been successfully used in other fields of surgery. Gurdjian,

capsule after enucleation, plastic spheres have been used by Wright,⁷ Cutler,⁸ Eggers,⁹ Berens and Rothbard,¹⁰ and others.

Five methyl-methacrylate implants, approximately 12 by 2 mm. in size, were inserted into the upper eyelids of three male albino rabbits through small inci-



Webster, and Brown⁴ used methyl methacrylate (plexiglass) for filling a skull defect and reported no deleterious action after 15 months. Walker, Taggart, and Lambros⁵ have also successfully used acrylic resin in the form of plates for filling skull defects; Brown,³ as implants for correcting nasal and chin deformities; Penhale,⁶ to correct facial deformities. Harmon,^{6a} used methyl methacrylate (plexiglass) for reconstruction of the femoral head. As an implant into Tenon's

sions in the skin and presumably part of the orbicularis. Two of the implants had been cured in boiling water, three had been treated by the longer process at a lower temperature. One of the latter was the pigmented type of methyl methacrylate resin often used in dentures. One of each of the three types of implants was allowed to remain for one month, after which the animals were killed. There was no visible difference in the tissue sections of any of the lids. The two remaining

implants were allowed to remain for two months, at the end of which period tissue sections showed no significant difference from those implanted for one month except for thinning of the connective tissue capsule. Grossly, the lids were soft, and the skin moved normally over the im-

dense fibrous tissue and lined by a flattened layer of fibroblasts and endothelial cells. A few scattered monocytes and lymphocytes are found in this granulation tissue. At the outer edge of the tract there are rare multinucleated giant cells of the foreign body type. A very few

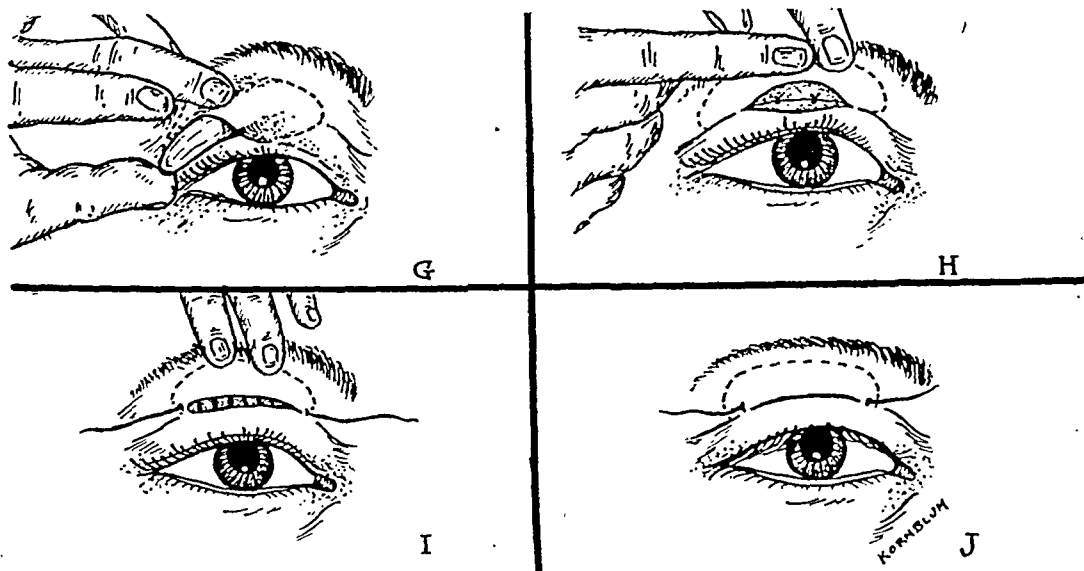


Fig. 4 (Sugar and Forestner). Procedure used for implantation of methyl methacrylate.

- A, Anesthesia.
- B, Implant placed in position on lid.
- C, Outline of implant drawn with gentian violet.
- D, Skin incision.
- E, Splitting of orbicularis. The orbital septum is exposed.

- F, The undetermined orbicularis in the area outlined on the skin.
- G, Insertion of the implant.
- H, Suturing of the orbicularis edges.
- I, Subcuticular skin suture.
- J, Operation completed.

plants. There was no gross evidence of inflammation. The implants were free and each was surrounded by a thin pale-pink membranous sac with a glistening inner surface. Microscopically, sections of the eyelid revealed* a "hollow tract bounded anteriorly by the subcutaneous connective tissue and fibers of the orbicularis muscle and posteriorly by a few fibers of the orbicularis muscle and the palpebral fascia. The tract is lined by chronic granulation tissue which, by compression and organization is being converted into

scattered lymphocytes and monocytes are found in the lamina propria of the conjunctiva" (fig. 3).

A biopsy specimen of the anterior wall of the implanted cavity was taken from one patient (case 7) during substitution of a longer implant, one month after insertion of the original implant. At the time of reoperation, the cavity had the same glistening pale-pink appearance described for the rabbit-lid implants. Microscopically, it had the same thin granulation tissue membrane around it that was found in the rabbit eyelids.

A total of 20 patients had methyl-

* Report by Major R. S. Aronson, pathologist.

methacrylate implants inserted, including the three patients on whom the original orbicularis-band procedure had been done.[†]

The implantation procedure is shown in figure 4. After the usual preoperative medication with morphine and scopolamine and preparation of the skin, a block type of anesthesia was employed (2-percent procaine-hydrochloride solution). A small quantity of procaine was injected through the skin over the supraorbital notch. The needle was carried down toward the inner canthus, and a small

its desired position on the upper lid (fig. 4B), about 1 mm. above the orbitopalpebral sulcus, with its temporal end lying just temporal to a vertical line drawn upward from the external canthus. The center of the implant then lay somewhat temporal to the center of the lid. An outline of the implant was drawn on the skin with a toothpick and a weak solution of gentian violet or mercurochrome (fig. 4C). A 15-mm. incision was made along the concave lower portion of the outline at its center (fig. 4D). The skin was held taut by an assistant who merely

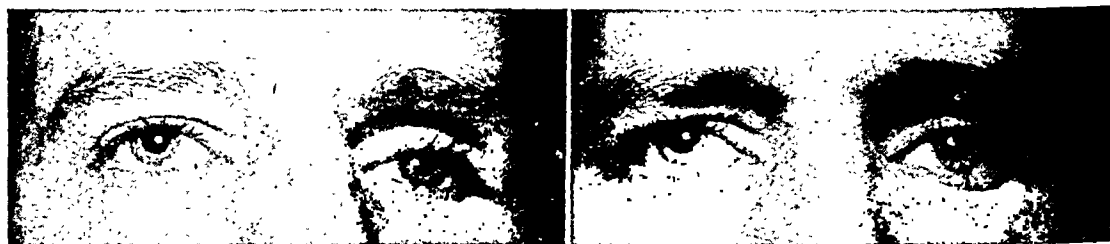


Fig. 5 (Sugar and Forestner). Photographs of case 2, showing results of the use of methyl-methacrylate implant.

quantity of procaine injected at the inner angle of the upper lid (fig. 4A). The needle was then inserted at the outer end of the brow, and carried down to the outer angle of the upper lid, a small quantity of procaine being injected along its path. Then the needle was pulled back and inserted under the skin of the brow toward the supraorbital notch, a small quantity of procaine being injected as the needle was inserted. This type of anesthesia does not interfere with the proper placing of the implant by distortion of the tissues and does not interfere with the levator action. After about 5 to 10 minutes, anesthesia was complete. The patient wore his prosthesis during the procedure. The implant was sterilized in mercury-bichloride solution and placed in

pulled the brow upward with two fingers.

As soon as the skin incision had been completed, the orbicularis muscle was exposed (fig. 4E). By blunt dissection with a Stevens tenotomy scissors, the orbicularis was split along the same line as the skin incision and the orbicularis undermined in the area of the implant outline, forming two pockets, nasally and temporally (fig. 4F). The orbital septum lying beneath the orbicularis was easily recognized. One end of the implant was then inserted, and the skin and orbicularis were pulled over the other end (fig. 4G). The implant lay smoothly in its prepared location. The edges of the orbicularis muscle were sutured together with two mild chromic (4-0) catgut sutures (fig. 4H). A subcuticular silk suture in the skin completed the operation (figs. 4I and 4J). A pressure bandage was applied.

[†]Since this paper was submitted for publication, two more implants have been satisfactorily used, one in a girl aged 10 years.



Fig. 6 (Sugar and Forestner). Photographs of case 8, showing results of methyl-methacrylate implant.

Of the 20 patients operated upon, 11 were out patients. The pressure bandage was removed after 24 hours in a few cases and after two days in the others. Wearing of dark glasses was advised, solely for cosmetic reasons, until the skin suture would be removed, on the fourth day. The only complications were two instances of lid ecchymosis which cleared within 12 days. These occurred in one

patient who had the bandage removed in 24 hours and in one who had the bandage on for two days. In case 7, an implant larger than the one originally used was required. In three others, a smaller implant was substituted (cases 13, 14, and 20). In case 18, the lid was manipulated on the second day, permitting the implant to turn over easily. It was later removed, and the sac split and rebanded after

TABLE 1

DATA ON USE OF METHYL-METHACRYLATE IMPLANTS

Case No.	Age	Status—Hospital or Outpatient	Date of Enucleation	Time Interval Between Enucleation and Original Wearing of Prosthesis	Tenon's Capsule Implant	Rapid or Slow-Process Implant	Size of Implant	Complications
1	31	O.P.	1930	2 weeks	None	Slow	7×28	None
2	27	Hospital	1941	10 days	None	Slow	8×29	None
3	23	O.P.	1944	2 months	None	Slow	6×25	None
4	39	O.P.	1913	5 days	None	Slow	7×28	None
5	23	Hospital	1945	1 month	Glass sphere	Slow	7×29	None
6	27	O.P.	1937	2 months	None	Slow	7×28	None
7	23	Hospital	1945	3 weeks	Glass sphere	Slow	8×30	None
8	16	O.P.	1945	2 weeks	Glass sphere	Slow	7×29	None
9	33	Dependent Hospital	1917	27 years	None	Slow	7×28	None
10	29	Hospital	1938	3 weeks	Glass sphere	Slow	7×28	None
11	22	O.P.	1935	3 months	None	Slow	7×30	Postoperative ecchymosis in lid 2d day
12	38	O.P.	1937	1 month	None	Slow	7×30	None
13	27	Hospital	1945	2 weeks	None	Rapid	6×28	Ecchymosis 1st day
14	28	O.P.	1941	2 weeks	None	Rapid	6×28	None
15	28	Hospital	1945	2 months	Sphere	Slow	7×30	None
16	24	Hospital	1944	3 months	None	Slow	7×30	None
17	30	Hospital	1941	1 month	None	Slow	7×29	None
18	35	O.P.	1943	2 days	None	Rapid	7×28	Implant turned over
19	32	O.P.	1944	10 days	None	Rapid	7×29	None
20	26	O.P.	1924	2 weeks	None	Rapid	5×28	None

reinsertion of the implant. Healing was uneventful. Substitution was easily made through the original 15-mm. incision. No instance of infection or untoward reaction occurred. The implant could be felt easily through the skin. It became forcibly elevated. Definite cosmetic improvement was obtained in all cases.

A summary of the pertinent findings in the patients on whom implantations were made is shown in table 1. Two interesting facts were ascertained in these cases: (1) that a prolonged interval between enucleation and the original wearing of a prosthesis is not necessarily a cause of sinking of the upper lid; and (2) that the presence of an implant in Tenon's capsule does not prevent the occurrence of lid sinking. In 11 of the 20 patients, there was a time interval of less than one month between the enucleation and the first wearing of a prosthesis. Five of the 20 had had spheres implanted

into Tenon's capsule after the enucleation.

The cases have been followed for a period of two to four months and there have been no untoward results.* No difference was observed in the results from the implants made by the slow or rapid process. It is hoped that further followup may continue over a period of years in order to complete this preliminary study.

CONCLUSIONS

A simple method is described for introducing a methyl-methacrylate implant into the upper lid to fill out the sinking which sometimes occurs after enucleation of the eyeball. Experiments and a review of previous experience with this resin have been cited to indicate the lack of untoward results from this procedure.

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* A follow-up by mail after six to eight months confirmed this conclusion.

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CHARTING DIPLOPIA AND MUSCLE ACTION*

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The action of each of the extraocular muscles is naturally determined by the manner of its attachments; that is, by its origin and insertion. Anyone who remembers and always visualizes the origin and insertion of each muscle will have no difficulty in determining its mode of action. However, teachers and writers of textbooks have always felt it necessary to devise some memory scheme which would help fix the pertinent facts in the student's mind. Many and varied schemes have been devised, but the inadequacy of most of these is probably best expressed by Sir J. Herbert Parsons, who, in his textbook, "Diseases of the eye," after explaining a mnemonic state, "... the student is even more liable to forget the mnemonic than his anatomy of the muscles."

The mnemonic which I employ is the old familiar benzene ring which every doctor knows from his early student days in chemistry. But before taking up the mnemonic it may be well to review very briefly the action of the extraocular muscles. The externi and the interni have simple actions. The right externus turns the right eye to the right (out), the right internus turns the right eye to the left (in). The left externus turns the left eye to the left (out) and the left internus turns the left eye to the right (in).

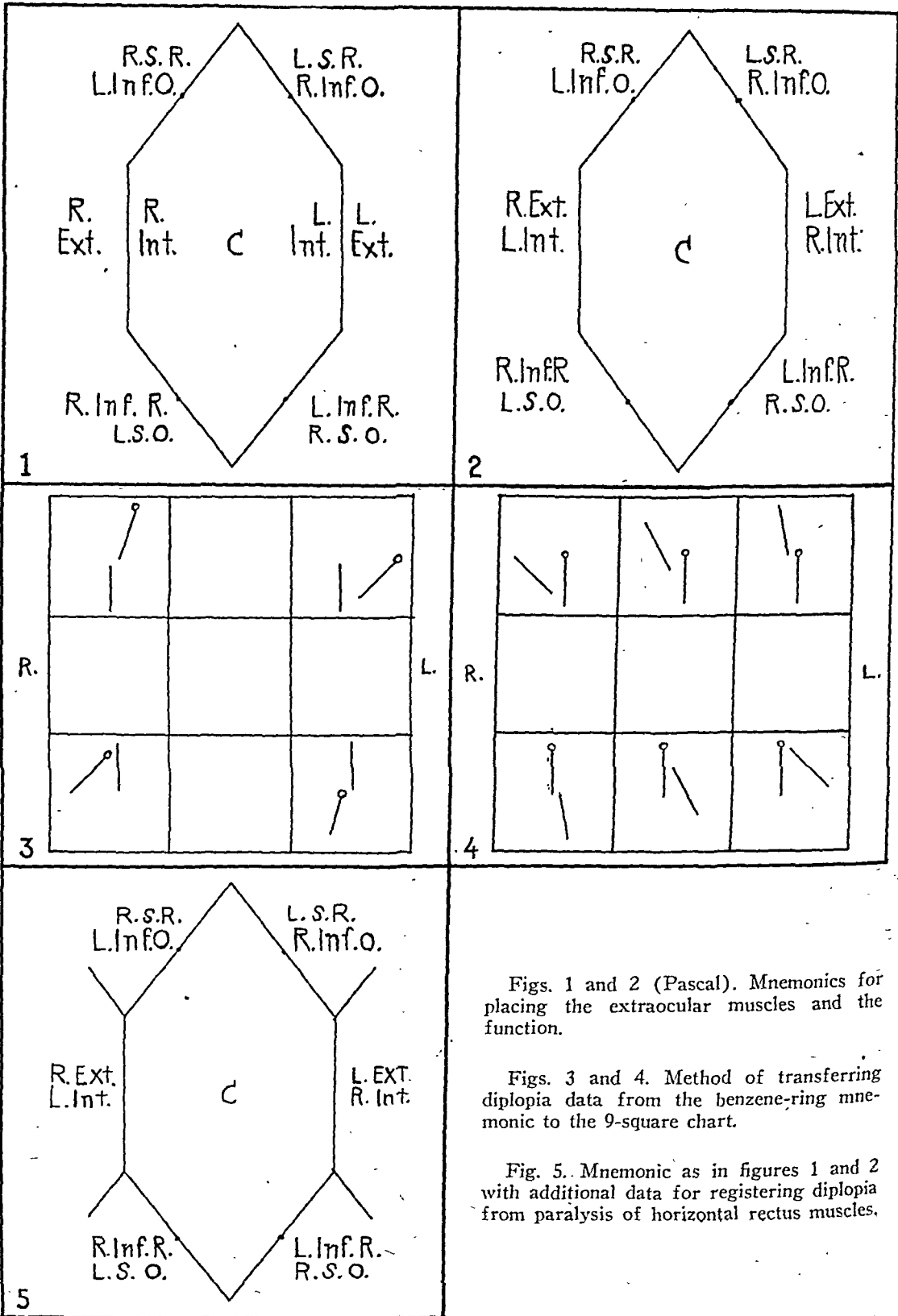
The vertically acting muscles have a threefold action, a primary action and two secondary actions. The primary action is up or down. The secondary actions are (a) a slight movement to right or left (in or out) and (b) a wheellike rotation or torsion—dextro-torsion when the upper part of the vertical meridian of the

cornea is turned to the right, or levo-torsion when the upper part of the vertical meridian is turned to the left. This may also be expressed as extorsion or intorsion according as the upper part of the vertical meridian is tilted toward the temple or towards the nose.

Figure 1 may be visualized as being directly behind or directly in front of the patient who faces us, so that right and left are the *patient's* right and left. The patient's eyes are directed straight forward; that is, they are in the primary position. The diagram is set in the mid-line, and the center of the ring, C, may be thought of as corresponding to the patient's bivisual line or to the projection of his nose. The rectus muscles are placed first, the muscles of the right eye on the right side of the ring and the muscles of the left eye on the left side of the ring.

At the right upper limb are placed the right superior rectus (R. S. R.) at the right middle limb, the right externus on the outside, the right internus on the inside, and at the right lower limb the right inferior rectus (R. Inf. R.). Similarly, on the left side of the ring, at the left upper limb the left superior rectus (L. S. R.), at the left middle limb, outside the left externus, inside the left internus, at the left lower limb the left inferior rectus (L. Inf. R.). Once the rectus muscles are set down at the places their names indicate, the position of the obliques is found from the general rule that the oblique muscles are placed at their *complete opposites*. Thus the right superior oblique is placed at the limb of the left inferior rectus, the right inferior oblique at the limb of the left superior rectus, the left superior oblique at the limb of the

* Presented before the New York Society for Clinical Ophthalmology, March 4, 1946.



Figs. 1 and 2 (Pascal). Mnemonics for placing the extraocular muscles and the function.

Figs. 3 and 4. Method of transferring diplopia data from the benzene-ring mnemonic to the 9-square chart.

Fig. 5. Mnemonic as in figures 1 and 2 with additional data for registering diplopia from paralysis of horizontal rectus muscles.

right inferior rectus, and the left inferior oblique at the limb of the right superior rectus.

The action of each muscle is now seen from the corresponding limb of the ring as follows: The R. S. R. (at the right upper limb) turns the right eye up, its principal action, a little to the left or in (the midpoint of the limb is shifted slightly to the left), and produces levotorsion or intorsion (secondary actions). The upper part of the vertical meridian of the right cornea is tilted to the left, corresponding to the slant of the right upper limb. The right externus and the right internus move the eye in the direction indicated by their positions, the right externus to the right (outward), the right internus to the left (inward). The right inferior rectus at the right lower limb moves the right eye down, its principal action, a little to the left or in (midpoint of limb is shifted to left), and produces dextro-torsion or extorsion (secondary actions). The upper part of the right cornea, like the upper part of this limb, is tilted to the right.

Similarly, the left superior rectus (at the left upper limb) turns the left eye up, its principal action, a little to the right or in (midpoint of limb is shifted slightly to right), and produces dextro-torsion, intorsion (secondary actions). The upper part of the cornea is tilted to the right, as is the case with the corresponding limb. The left externus and left internus move the left eye as indicated by their position. The left inferior rectus (at the left lower limb) turns the left eye down, its principal action, a little to the right or in, and produces levo-torsion or extorsion (secondary actions). The upper part of the vertical meridian of the left cornea is tilted to the left, as indicated by the slant of the corresponding limb.

The right superior oblique (at the limb of the left inferior rectus) moves the

right eye down, its principal action, a little to the right or out (midpoint of limb is shifted to right), and produces levo-torsion or intorsion (secondary actions). The upper part of the right cornea is tilted to the left, as the corresponding limb. The right inferior oblique (at the limb of the left superior rectus) turns the right eye up, its principal action, a little to the right or out, and produces dextro-torsion or extorsion (secondary actions), all of which actions are indicated in the corresponding limb. The left superior oblique (at the limb of the right inferior rectus) turns the left eye down, its principal action, a little to the left (out), and produces dextro-torsion or intorsion, as indicated by the corresponding limb. The left inferior oblique (at the limb of the right superior rectus) turns the left eye up, its principal action, a little to the left (out), and produces levo-torsion (extorsion), as indicated by the corresponding limb.

Visualizing the ring does more than help one remember the complete action of each of the extraocular muscles. After using the mnemonic several times one learns to "project" the ring, so to say, onto the eyes and to visualize directly the action of the muscles, especially the three-fold action of the vertical muscles, by the position, shift, and slant of the corresponding limb.

The "ring" also shows the greatest field of action of the various muscles. The principal action of the vertical muscles on the right side of the ring is most marked when the eyes are turned to the right as the starting position. Thus the up-and-down effect on the right eye by the right superior rectus and the right inferior rectus is most marked when the right eye is turned to the right (out). Similarly, the up-and-down effect on the left eye by the left inferior oblique and the left superior oblique is most marked

when the left eye is turned to the right (in). When the principal action is most marked, the secondary actions are least marked. Therefore, when the eyes are turned to the right, the secondary actions of the muscles situated on the right side of the ring are least marked. When the eyes are turned the other way—that is, to the left—conditions are just reversed, as would be expected. The principal (up-and-down) action of the muscles situated on the right side of the ring is now less marked, whereas the secondary actions are more marked.

Similarly, the principal action of the vertical muscles on the *left* side of the ring is most marked when the eyes are turned to the *left*. Their secondary actions are then least marked. When the eyes are turned the other way—that is, to the right—the principal action of these muscles is least marked and their secondary action most marked.

For those interested only in remembering the action of each of the extraocular muscles, figure 1 is adequate. But for those interested in the action of the associated muscles in binocular vision and for charting the type and position of the false image in diplopia, figure 2 is preferable.

The benzene ring is drawn and the muscles placed in pairs, each with its associate as follows: Beginning at the right upper corner are placed the right superior rectus (as indicated by name) and, immediately below, the name of its associate muscle, which is its complete opposite; namely, the left inferior oblique. At the right middle limb outside, are placed the right externus (as indicated by name) and, immediately below, the name of its associate, its complete opposite, therefore the left internus. At the right lower corner, are placed the right inferior rectus (as indicated by the name) and, immediately below, its associate, its complete

opposite; namely, the left superior oblique.

At the left upper corner are placed the left superior rectus (as indicated by the name) and, immediately below, its associate (its complete opposite); namely, the right inferior oblique. At the left middle limb outside are placed the left externus (as indicated by name) and, immediately below, its associate (its complete opposite); namely, the right internus. At the left lower corner are placed the left inferior rectus (as indicated by name) and, immediately below, its associate (its complete opposite); namely, the right superior oblique.

This ring is a complete mnemonic and the only one necessary to remember for all muscle work. It shows the most characteristic field of action of each muscle and of each group of associated muscles. For the right externus and left internus it is to the right, as shown by the right middle limb. For the left externus and right internus it is to the left as shown by the left middle limb. The vertical movement is most marked at the corner indicated. Thus for the R. S. R. and the L. Inf. O. the greatest vertical movement (up) is at the right upper corner; that is, when looking up and to the right. For the L. S. R. and the R. Inf. O. the greatest vertical movement (up) is at the left upper corner; that is, when looking up and to the left. For the R. Inf. R. and the L. S. O. the greatest vertical movement (down) is at the right lower corner; that is, when looking down and to the right. And for the L. Inf. R. and the R. S. O. the greatest vertical movement (down) is at the left lower corner; that is, when looking down and to the left.

The secondary actions, especially the torsion, are most marked in the opposite corner: that is, for the R. S. R. and the L. Inf. O. the greatest torsion is at the left upper corner; for the L. S. R. and

the R. Inf. O. the greatest torsion is at the right upper corner. For the R. Inf. R. and the L. S. O. the greatest torsion is at the left lower corner, and for the L. Inf. R. and the R. S. O. the greatest torsion is at the right lower corner. All this simplifies the statement that the greatest up-and-down movement is at the corner marked up or down, whereas the greatest torsional movement is at the opposite corner.

The diplopia resulting from a paretic muscle is easily charted from the ring (fig. 2) because, to paraphrase Maddox, "the false image is what the normal muscle *does*." The "false image," of course, belongs to the eye with the paretic muscle. In paralysis of the right externus or its associate the left internus, the false image is to the right (out), and is farthest from C, when the gaze is in the direction of the right middle limb. The separation of the images diminishes when the gaze is in the other direction; that is, toward the left middle limb. In paralysis of the left externus or its associate the right internus, the false image is to the left (out), and is farthest from C when the gaze is in the direction of the left middle limb. The separation of the images diminishes when the gaze is in the other direction; that is, toward the right middle limb.

In paralysis of the R. S. R. or L. Inf. O., the false image is higher, most marked in the right upper corner at the right upper limb and is tilted to the left, the tilt becoming more marked when the gaze is toward the opposite (left upper) corner. In paralysis of the L. S. R. or R. Inf. O., the false image is higher, most marked in the left upper corner, at the left upper limb, and is tilted to the right, the tilt increasing on looking to the opposite (right upper) corner.

In paralysis of the R. Inf. R. or L. S. O. the false image is lower, most marked in the right lower corner, at the right

lower limb, and is tilted to the right, the tilt increasing when the gaze is toward the opposite (left lower) corner. In paralysis of the L. Inf. R. or R. S. O., the false image is lower, most marked in the left lower corner at the left lower limb, and is tilted to the left, the tilt increasing when the gaze is to the opposite (right lower) corner.

The slight horizontal displacement of the false image in paralysis of a vertically acting muscle may be neglected, for it is of little value and is sometimes confusing, but it, too, is implicit in the figure.

While the "ring" is the basic figure for charting the diplopia, it is desirable to transfer the information derived from the ring to the 9-square diplopia chart for more detail. Let the image of the right eye be designated by a line with a little circle on top (round head, right eye), and the image of the left eye by a simple line. In a case of paralysis of the R. S. R., the false (right-eye) image is shown by the right upper limb of the ring. The true image, fixated by the left eye is recorded in the right upper square, figure 3, where the vertical separation will be most marked; the false image is shown as higher, to the left, and levo-torted, as indicated by the right upper limb. At the opposite corner, the left upper square, is placed the false image so that the vertical separation is less, the torsion greater.

Or, in a case of paralysis of the R. S. O., the false (right-eye) image is shown by the left lower limb. Record the true image, fixated by the left eye, in the left lower square, figure 3, where the vertical separation will be most marked; the false image lower, to the right and levo-torted, as indicated by the left lower limb. At the opposite corner, the right lower square, is placed the false image, so that the vertical separation is less, the torsion more.

The false image resulting from paral-

ysis of any other muscle can likewise be "seen" on the ring and transferred for greater detail to the 9-square chart.

The 9-square diplopia chart can also be used, and to some this seems especially convenient, by starting from the middle square, corresponding to the primary position of the eyes. Paralysis of any of the muscles at the upper limbs of the ring will cause diplopia, principally in the upper field, and paralysis of the muscles placed at the lower limbs of the ring, principally in the lower field. Thus, for example, in paralysis of the L. S. R. the false image corresponds to the left upper limb. Transferred to the 9-square chart and starting from the upper middle square, the false (left-eye) image relative to the fixated (right-eye) image will be higher, to the right, and dextro-torted, figure 4. In the left upper corner (principal field of action of the affected muscle), the vertical separation will be more marked, the torsion less. In the opposite corner (right upper square) the vertical separation will be less marked, the torsion more. Lower part of figure 4 shows the false image transferred from the ring in paralysis of L. S. O. When the three upper or the three lower squares are filled in, the diplopia in the middle squares can be filled in if a complete textbook picture is desired. Figures 3 and 4 are considered as they face the patient, as if the examiner were facing the patient from behind the chart. Right and left are according to the patient's right and left.

Those interested in some refinements in charting diplopia may memorize figure 5 instead of figure 2 as a complete mnemonic. It is an amplification of figure 2 and gives additional information about the diplopia resulting from paralysis of the horizontal rectus muscles. It consists of the main benzene ring, as in figure 2,

with the beginnings of another ring on each side. It shows everything figure 2 shows with this additional information:

The right upper extension shows that in paralysis of the right externus or left internus the false image tilts to the right when looking up and to the right. The right lower extension shows that under similar conditions the false image tilts to the left when looking down and to the right.

Similarly, the upper and lower extension on the left shows that in paralysis of the left externus or right internus the false image tilts to the left on looking up and left, and tilts to the right on looking down and left. The torsion is always the same as the slant of the corresponding limb in the direction indicated.

The benzene-ring mnemonic, can also be used for remembering muscle action by referring the action to the muscles of one's own eyes. Exactly the same method is used, but "right" and "left" of the ring must be reversed. Similarly, for charting the false image, the ring and the chart may be considered as facing the patient and also the examiner. Here, too, everything works out exactly the same, but "right" and "left" must be reversed. Some textbooks use one method, some the other, but either method is compatible with the ring mnemonic.

A mnemonic is merely an aid to visualizing muscle action. When used with intelligence, this mnemonic has been found useful not only for remembering the action of the individual muscles and for textbook charting of the false image when the paralyzed muscle is given, but also for helping to locate the paralyzed muscle from the position and tilt of the false image.

37 West 97th Street.

NOTES, CASES, INSTRUMENTS

STREPTOMYCIN TREATMENT OF A CORNEAL ABSCESS CAUSED BY *ESCHERICHIA* *COLI**

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There has been an intensive search for a chemotherapeutic agent active against organisms resistant to the sulfonamides and penicillin. Recent experiments show that streptomycin, a new antibiotic, partially fulfills this need. Waksman and his associates isolated this antibiotic from the filtrate of a meat-extract culture of *Actinomyces griseus*.¹ Streptomycin is bacteriostatic against certain gram-negative as well as gram-positive organisms. This activity has been demonstrated *in vitro*, in animals, and in preliminary experiments in man. Among the organisms against which it appears to be effective are *Escherichia coli*, *Mycobacterium tuberculosis*, *Eberthella typhosa*, *Brucella abortus*, *Pasturella tularensis*, *Hemophilus influenzae*, and *Proteus vulgaris*. Preliminary reports have shown no significant toxicity when streptomycin is administered orally, subcutaneously, or intravenously at therapeutic levels.²

A small amount of streptomycin became available during the treatment of an apparently intractable case of *Escherichia coli* abscess of the cornea. Its use was followed by dramatic improvement.

CASE REPORT

W. T., a colored man, aged 54 years, was first admitted to the Ophthalmological Service on June 26, 1945, complaining of poor vision, lacrimation, photophobia,

and pain in his right eye. He stated that three weeks before admission a "piece of gravel" had lodged on the cornea of his right eye. In spite of local and systemic treatment by his family doctor, a corneal ulcer developed. Prior to the present illness, the patient had had no ocular complaints.

Examination. The routine laboratory and general physical examinations were negative except for slight peripheral arteriosclerosis. The blood pressure was 170/88, the blood sugar 89 mg. percent, and the serologic tests for syphilis were negative.

Right Eye. There was marked edema of both lids with a spastic entropion of the lower lid. Slight mucopurulent discharge was present. The palpebral and bulbar conjunctivas were markedly hyperemic, and the pericorneal vessels were intensely injected. In the center of the cornea was an opaque area 6 to 7 mm. in diameter, extending throughout the entire corneal stroma. The surface was irregularly excavated, with ragged overhanging edges. This entire area stained heavily with fluorescein. The surrounding rim of cornea was slightly infiltrated in the superficial layers of the stroma. The anterior chamber was of normal depth with a hypopyon in the lower third. The aqueous ray was moderately positive. The iris and lens could be seen only with difficulty; the pupil appeared well dilated and the lens was grossly clear. Tension was slightly elevated to fingers. There was no red reflex. Vision was limited to light perception with good projection.

A culture of the corneal abscess taken on admission showed a heavy growth of *Escherichia coli*.

Left Eye. External, ophthalmoscopic and slitlamp examinations revealed no

* From the Wilmer Ophthalmological Institute of The Johns Hopkins University and Hospital, Baltimore.

abnormalities. Corrected vision was 20/20, and visual fields were normal.

Therapy and Course. The patient was given 10,000 units of penicillin intramuscularly every three hours during the day and night, and 1 gm. of sulfamerazine orally twice a day. Local treatment consisted of the instillation of one drop of a 10-percent solution of argyrol followed by irrigation with boric-acid solution every four hours. Penicillin ointment (500 units per cubic centimeter) was

taining 500 standard units of streptomycin per cubic centimeter were instilled into the right eye every hour during the day and night. In 48 hours, there was marked improvement. The cornea had begun to clear in the periphery and the abscess was more shallow. On the fifteenth hospital day, the systemic use of penicillin and sulfamerazine was discontinued. At the same time, through a mistake in dilution, the concentration of the streptomycin instilled into the conjunctival sac was in-



Fig. 1 (Owens). Right eye before treatment with streptomycin. Fig. 2, The same eye 19 days after treatment with streptomycin.

placed into the conjunctival sac following each irrigation. In addition one drop of a 1-percent solution of atropine sulfate was instilled twice a day. Nevertheless, the abscess continued to progress rapidly. On the fifth hospital day, two subconjunctival injections of 0.25 c.c. of a solution containing 10,000 units of penicillin per cubic centimeter were given six hours apart. These also had no effect. In addition to the necrotic corneal abscess, a complete posterior synechia and a mature cataract had developed. The patient had lost light perception in this eye, and it was thought enucleation was inevitable.

On the seventh hospital day, a small amount of streptomycin became available.* The local use of penicillin was discontinued. Two drops of a solution con-

creased to 10,000 standard units per cubic centimeter. This concentration was used for one week after which the original dilution containing 500 standard units per cubic centimeters was used again. During this period of increased dosage, the eye continued to improve steadily. The local use of streptomycin was continued for a total of 23 days. At that time the corneal abscess had healed and was replaced by an epithelized leukoma.

On August 14, 1945, the patient was discharged from the hospital. The lids were normal. The bulbar and palpebral conjunctivas showed minimal hyperemia. A central leukoma, 5 mm. in diameter,

* The streptomycin was generously supplied by Merck and Company, Inc., Rahway, New Jersey.

extended through the entire thickness of the cornea. Its surface was completely epithelized and did not stain with fluorescein. There was a bullous area 1 mm. in diameter at the lower nasal margin of the leukoma. The anterior chamber was deep. The aqueous ray was negative and there were no keratitic precipitates. A complete posterior synechia bound the

iris to a mature cataract. The ocular tension was normal to fingers. There was no light perception.

CONCLUSION

A severe corneal abscess caused by *Escherichia coli* responded to the local use of streptomycin.

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RECONSTRUCTION OF THE FLOOR OF THE ORBIT*

REPORT OF A CASE

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In a case of severe comminution of a malar bone associated with the floor of the orbit, the level of the eyeball may be displaced downward and the attachment of the inferior oblique muscle disturbed. Pfeiffer¹ reported 53 cases of traumatic enophthalmos. He related the mechanism of the internal orbital fracture responsible for the posterior displacement of the eye to be as follows:

"The posterior convex position of the floor bulges upward back of the eyeball in a position to receive most of the force transmitted by the eye. The floor is very thin, similar in weight to the lamina papyracea and is braced but slightly by the infra-orbital groove or canal. In cases of more severe enophthalmos, the posterior portion is fractured and in cases of more severe displacement the entire floor is broken through."

Central vision was destroyed in only 4 of 24 cases. Treatment is usually deferred from three to six months until residual inflammatory thickening and induration of soft tissue have disappeared. Wheeler² suggested the use of fascia lata gently tucked into the cavity. It should be completely covered so that it will not be exposed to air. Skin edges are prepared for the halving union and brought together by 000 chromic catgut. Converse³ suggested bone as employed by Gillies. He stated that there is clinical evidence of reossification and survival when these are placed against bone subperiosteally. Spaeth⁴ utilized cartilage either mortized or cut to shape. He emphasized the advantage of preserving

perichondrium if the cartilage is mortized.

The following report is made of an extreme case which was improved with cartilage cut to shape and preserved from cadavers. Cadaver cartilage is removed under strictly aseptic conditions from individuals who have no communicable disease. The cartilage is cleansed and the perichondrium taken off. It is kept continuously in a refrigerator in a solution of normal saline (four parts) and solution of merthiolate (one part). The solution is changed weekly. Culture of the solution must be made each time before use.

CASE REPORT

C. P., a white woman, aged 43 years, was admitted to the Beth David Hospital on November 29, 1944, after having jumped from a sixth floor with suicidal intention. In addition to the injury of the left orbit, the patient had fractures of the frontal bone, the left zygoma, the nasal bones, mandible, head of the right humerus, transverse processes of the third and fourth lumbar vertebrae, pubis, neck of the left femur, and the left tibia and fibula.

Her past history was irrelevant except for the fact that a diagnosis of involutional melancholia had been made previously. Ophthalmologic examination on January 12, 1945, showed the lower border of the left orbit to be 10 mm. lower than that of the right orbit.

With the exophthalmometer, measurements of 14 mm., in the right eye, and of 5 mm., on the left eye were found. The palpebral aperture of the right eye measured 10 mm.; that of the left eye, 8 mm. In the left palpebral aperture, one could see only 1 mm. of the cornea above the lower lid, for the rest of the eyeball was pushed down into the antrum (fig. 1). There was a marked paresis of the left

* From the Ophthalmological Service of Beth David Hospital.

superior rectus and inferior oblique muscles. Hypotropia measured 60 P.D.

On February 16th, after her more serious fractures had been cared for, a reconstruction of the floor of the orbit was undertaken.

(1) A skin incision was made along the lower border of the left orbit down to the periosteum. The latter was incised, and the orbital content elevated subperiosteally.

(2) The elevator was carried back for a distance of 12 mm. from the orbital rim.



Fig. 1 (Givner). Patient reported by Pfeiffer* showing severe enophthalmos of somewhat less severity than was present in the case herewith reported.

A piece of costal cartilage was then shaped to fit the defect, arching upward and elevating the eye 12 mm. Bleeding was controlled (fig. 2).

(3) The periosteum was reunited with chromic catgut, and the orbicularis reinforced with the same type of suture. The skin was closed with interrupted dermal sutures, and a pressure bandage applied. The patient was put on sulfadiazene systemically. The first dressing was done after five days. The first postoperative result showed the globe to have returned to the palpebral aperture, but with a noticeable hypotropia (fig. 3).

The status of the patient at the time of writing this is: At 105 mm., the right eye

* Acknowledgment is made to Dr. R. L. Pfeiffer and to the Archives of Ophthalmology for permission to use this photograph. The latter appeared on page 724. See reference 1.

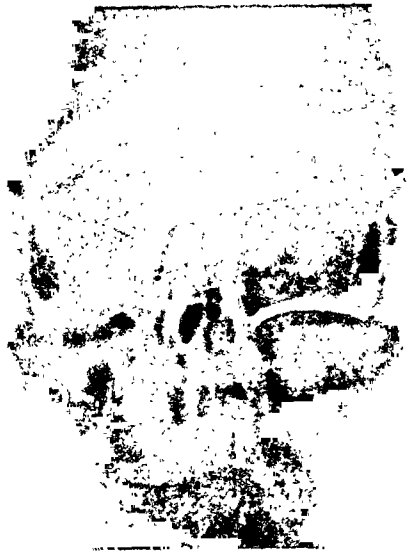


Fig. 2 (Givner). Implanted cartilage inked in to show approximate position.

measures 14 mm.; the left eye, 8 mm. Vision is: R.E., with a +0.50D. cyl. ax. 180°, 20/20; left eye, with a plano, 20/20. The remainder of the examination, including media, tension, fields, and fundi, shows nothing abnormal in either eye.

In making a survey of materials used for cranioplasty, one finds such substances as animal bone, celluloid, aluminum, gold, silver plate, platinum, decalcified bone and buttons of bone. More recently, use has been made of bone chips and whole blood. Alloplastic substances such as vitalium have received attention, but plates of this material are difficult to mold and get into shape. In September,



Fig. 3 (Givner). Patient as pictured nine months after the operation.

1942, Col. R. G. Spurling (MC) performed the first cranioplasty with tantalum implant, in the Walter Reed Hospital. This material is valuable because: (1) It is relatively inert in tissues, although a thin, translucent, connective-tissue capsule does appear about this element when used in the form of tantalum foil. (2) It is malleable, without loss of strength. Flat sheets, .015 and .020 in. thick and 6 in. square, are now available. Certain resins such as plexiglass (methacrylate) appear to be entirely inert in tissues and may yet prove valuable.

CONCLUSION

Interest of this case lies in the fact that:

1. It is an addition to the literature describing how good visual function was preserved in spite of marked traumatic enophthalmos.

2. The perichondrium is not absolutely necessary for a successful subperiosteal implant.

3. A periosteal implant may be taken from cadavers and put in as an arch to elevate the globe without interfering with intraocular pressure or function.

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SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

May 7, 1945

DR. MILTON L. BERLINER, *presiding*

ESSENTIAL XANTHOMATOSIS WITH HYPERCHOLESTEREMIA

DR. ALLEN DELEWETT said that essential xanthomatosis is one of the lipodystrophies or disorders of fat metabolism. The most widely supported theory concerning the etiology of these derangements is that there is an intracellular disturbance of lipid metabolism, perhaps due to a faulty enzymatic system, that results in the accumulation of large quantities of fatty substances within the cell. These fat-laden cells are called foam cells and their presence is the characteristic feature of the lipodystrophies. A family of nine was described, all of whom have essential xanthomatosis with hypercholesteremia and four of whom, aged 10, 11, 14, and 51 years have an arcus senilis. In 27 percent of the total series of 48 cases of essential xanthomatosis with hypercholesteremia, there was an arcus senilis; one half of these patients were younger than 40 years. It is probable that histologic examination of the arcus in such cases would reveal collections of cholesterol-laden cells in the corneal layers. The cornea is one of the more frequently involved sites of lipid infiltration in this disease.

OCULAR CHANGES IN RATS ON AMINO-ACID (TRYPTOPHANE) DEFICIENT DIETS

DRS. ARMANDO FERRARO and LEON L. ROIZIN have been studying the effects of amino-acid-deficient diets upon the growth, development, and morphology of

the various body tissues, organs, endocrine glands, and nervous system in rats, for the past three years.

In this preliminary report, Dr. Roizin limited himself to describing and discussing only the ocular involvement in rats on experimental tryptophane-deficient diets.

Material and Method. A total of 89 young (45-55 gm.), adult (100-120 gm.), and older (200 gm.) albino rats, belonging to the same strain, litter, and sex (male), was used in these experiments.

The animals were separated into four groups: The first group was fed on a tryptophane-deficient diet as suggested by Albanese and co-workers with the exception that the vitamin mixture was administered according to the method of Riess and Block. The other three groups of rats were used as controls.

Experimental findings. Most of the animals on tryptophane-deficient diet disclosed, in various degrees, arrest of growth, loss of body weight, changes of the general appearance, alterations of the fur (structural changes, rarefaction, and alopecia), and atrophy of the gonads. In addition, ocular involvement of various degrees of intensity was noticed, particularly in the very young animals and the group of rats weighing 100-120 gm. at the beginning of the experiment. These ocular involvements may be described as follows:

1. Spectacle eyes with very marked edema and congestion of the eyelids and conjunctiva, with presence of catarrhal and mucous secretion, causing at times adherence and complete occlusion of the eyelids, unless treated with medicinal or saline solutions. These changes appeared from 4 to 6 weeks after the beginning of the experiments.

2. Various degrees of cataractous changes of the lens, particularly in the more developed animals, appearing within 5 to 11 weeks from the beginning of the experiment. In addition, a large number of animals revealed very marked vascularization (hyperemia and hyperplasia) of the cornea, which was not limited to only certain parts, but involved the entire corneal circumference.

During the animals' lifetime, ophthalmologic examination of their lenses was conducted by Dr. Givner, who noticed various degrees and different types of opacities.

Histologic investigation disclosed various degrees and different types of opacities and structural changes of the lens in a large number of animals on tryptophane-deficient diet. At times the morphologic alterations were distributed in layers, lamellae, or concentric formations; at others, complete disorganization or disruption of the histologic structure was observed.

Clinical observations indicate that certain of these ocular manifestations—such as, spectacle eyes and involvement of the conjunctiva—are definitely reversible. To what extent and degree the involvement of the lens is also reversible the authors do not know at the present time, because their histologic data are not complete. However, some of the results in certain animals are very encouraging as far as improvement could be gauged by external appearance and ophthalmologic examinations.

Discussion. Dr. Isidore Givner said that tryptophane corneal vascularization has been said to be characteristically localized in the nasal and temporal portions of the cornea. The animals herein reported showed vascularization in all zones of the cornea. After tryptophane administration the corneal vessels narrowed but were still present on slitlamp study.

Tryptophane must be supplied in the diet, since the rat cannot synthesize it, at least in adequate amounts. A question that presents itself is: How applicable is the deficiency diet to human beings? In the proteolysis of lenticular proteins, tryptophane has been found in addition to 14 other amino acids. If we consider that the average time in rats for the development of tryptophane cataract is two months and that their life expectancy is three to four years, a comparable time in humans would be about three years on a tryptophane-deficient diet. In spite of the fact that amino acids are necessary for the elaboration of lenticular proteins, according to our present state of knowledge, and considering the ubiquity of this amino acid, Dr. Givner does not believe one could categorically attribute cataract in the human to this factor.

Slitlamp examination at regular intervals indicates a certain pattern in the method of development of the cataract in the rat. A feathery opacity with leaflike margins developed in the posterior subcapsular cortex. The suture lines were clearly visible and gaped slightly. Medium-sized vacuoles were visible in the suture lines and later under the anterior capsule. Later spokelike opacities appeared in the anterior cortex, followed by perinuclear opacities. The latter gave a milky appearance to the lens; and the nucleus became more opaque. The perinuclear zone widened. In looking at the lens through the dilated pupil, with room light at first, the pupil appeared grayish, but in the final state pearly white. In the gray stage, a red reflex was obtained with the ophthalmoscope but was obliterated when the pupil was pearly white.

After the rats have been given tryptophane, the pearly white opacities became less dense, so that the red reflex was obtained. There has been insufficient time to see how far this reversible change will

continue. If the change is one of fluid imbibition, it is reversible; if there is coagulation it is irreversible. About 65 per cent of the whole lens is composed of water. Part is free and part bound. It would seem in the development of cataract that the initial increase in water content is essentially an osmotic effect, owing to the high pressure generated by the fragmentation of large protein molecules into the smaller osmotically active derivatives of autolysis; this water remains free, accumulating beneath the capsule, and gathering in vacuoles and in fissures in the sutures. Such an accumulation impairs the transparency of the tissue, a tendency increased by the lessened imbibitional power of the lenticular proteins, so that while the free water increases, the bound water is lessened. Some of this state of edema certainly resolves, and optical transparency returns. The difficulties of observing microscopic changes corresponding to opacities seen in living animals in experimental work are well known, yet where we have reported vacuolization, the histo-pathologic specimen has at least shown this change. When we consider that the only cells that show regenerative activity are of the subcapsular epithelium, the explanation for lens clearing thus far will therefore have to be on a basis of water transference.

Finally, from a clinical point of view, no objection can be made to accept the recommendation that persons past the middle age and particularly those showing vacuoles, lamella separation, and water clefts be placed upon a well-balanced diet supplemented with vitamins, particularly vitamin C and vitamin-B complex.

As new findings of the physicochemical processes in the lens are uncovered, it is quite possible that medical treatment of early cataract will play a more prominent role.

ROUND-TABLE DISCUSSION ON NUTRITION

Panel comprised by Drs. Norman Jolliffe, H. D. Kruse, Harry Solomon, and Arthur Yudkin

Question. What vitamins can be synthesized in the human body and in what way can this be effected?

DR. NORMAN JOLLIFFE. The chief example is vitamin K. Others have been shown experimentally by deficiency symptoms as a result of egg-white injury; on record is a human case due to a self-imposed diet of sherry and two eggs. A group of workers experimentally demonstrated in the human gut the synthesis of thiamin and riboflavin; although subsequently the diet used was found to contain thiamin, the possible synthesis of riboflavin by bacteria in the gut is still valid.

Question. What ocular expressions of vitamin-B deficiency have you found in human subjects in New York City?

DR. F. H. KRUSE. The symptoms of B₂ deficiency, as seen in New York, are photophobia, lacrimation, and ocular fatigue; the tissue changes are vascular engorgement at the limbus and invasion of the cornea. The cases are usually chronic, although some are subacute; acute cases, such as were found in the Indians of Northern Manitoba, are not seen. Recession of the fully developed acute form may take place in a matter of days, whereas the chronic variety may not clear up for years. The symptoms disappear before the tissue changes.

Question. Discuss the question of increased viral antibodies in thiamine deficiency.

DR. SOLOMON. Mice experimentally infected with the virus for poliomyelitis were found to have a longer incubation period for the disease and a lower frequency of paralysis when on a diet de-

ficient in thiamin as compared to control groups on adequate diets. Malnutrition is not a factor, as the rates are essentially the same on starvation and adequate diets.

Question. Have you ever seen cataract development influenced by nutritional factors? What irrefutable evidence can you present to support your conclusions?

DR. A. M. YUDKIN. The question as it now stands cannot be answered by yes or no. The etiology or the mechanism of cataractous formation is still unknown. The causes of cataract are many and various, and it may be that they affect the transparency of the lens in many different ways. That general metabolic disturbances have an influence in the determination of cataract has always seemed obvious, both on account of the bilaterality of the condition and because of its tendency to develop in conditions of ill health.

There is no reason to suppose that there is only one cause or one principal cause operating in all cases.

Two definite changes in the structure of the lens produce diminished vision. One change is swelling of the tissue; the other, the formation of visible lenticular opacities. By means of the slitlamp the swelling of the lens tissue is found to be, in many instances, an invasion of the subcapsular tissue and that of the adult nucleus with fluid.

Although a considerable amount of information has been accumulated concerning the chemical changes that take place in the formation of cataracts, no definite clue to the etiology of the abnormal fluid in the tissue has been discovered.

It is a fact that the second condition, represented by the formation of opacities in the lens, is a "breaking down" of the structure of the normal lens tissue. This condition of the lens is not reversible from opacity to transparency. The first-named change is probably essentially one

of hydrolysis, whereas the second is a process of coagulation. It is apparent from analyzing the numerous papers on nonsurgical treatment of cataract that several prominent ophthalmologists have been able to check the progress of incipient stages of cataract either by using local medication and irritation, or by removing foci of infection and building up the body with proper food, or by a combination of local and general treatment. There is no irrefutable evidence that nutritional factors alone can produce a reversible condition in cataract formation if there is a derangement and destruction of the normal lens tissue. However, a review of some of the cases wherein lens changes have been repaired, or a reversible action has taken place by treatment with a well-balanced diet supplemented with vitamin-B complex and vitamin C, reveals that these cases belong to the first group of lens changes, namely, swelling of the lens tissue. Cataracts have been produced experimentally by depriving the laboratory animal of riboflavin or tryptophane and by substituting lactose or galactose in the diet for dextrose. If the diet was corrected before definite opacities were formed in the lens, the lens tissue did not develop into mature cataracts. When the lens was altered so that matured cataracts were formed, the improved diet had no reversible effect on the lens. Once coagulation invades the lens tissue, a reversible or regressive process does not take place with restoration of a well-balanced diet plus any of the known vitamins.

Question. What are conditioning factors and how may they influence the nutritive status?

DR. JOLLIFFE. They are the factors associated with disease, growth, or ordinary living conditions, such as sunlight, which will increase the requirements or the excretion or destruction of nutrients or fac-

tors that will impair their absorption for utilization. Increase of the bodily metabolism by hyperthyroidism, physical exertion, or restlessness over a period of time will raise the amount of vitamins required. An example of a factor which may destroy certain of the nutrients is the alkaline therapy, used in cases of gastrointestinal disease, that can destroy a large part of the thiamin intake. Large amounts of the sulfa drugs may block the action of the vitamins in the tissues. Certain vitamins are stored in the liver, and hepatic disease may prevent their storage on days when an excess is present, thereby failing to provide for periods of insufficient intake.

Question. What ocular expressions of vitamin-A deficiency have you found in human subjects in New York City?

DR. KRUSE. These occur in the conjunctiva near the limbus at the horizontal meridian and are chronic in type. There is thickening, opacification, and discoloration. These chronic changes are to be distinguished from keratomalacia and Bitot's spots, which are acute. The acute states in this region have all been superimposed on the chronic. The initial site is the last to clear when recession occurs.

Dr. Jolliffe. What is the relation between the conjunctival changes and those commonly seen in the skin?

Dr. Kruse. The skin changes do not appear in the absence of conjunctival changes which, however, may alone be present.

Question. Have you ever seen diabetic changes influenced by dietary or vitamin therapy?

DR. YUDKIN. Diabetes mellitus is a metabolic disorder that produces tissue changes in all organs of the body. The prominent changes observed in the ocular tissue are edema and vesiculation of the

pigment layers of the iris, curious focusing changes in accommodation, diabetic amblyopia, lenticular changes, and a retinopathy. The retinopathy is the complication most frequently encountered. I believe it occurs mostly in longstanding, uncontrolled mild cases, for it is far less common in diabetes of short duration or under good control from the start. The changes in accommodation are found at some stage in most diabetics. Usually, when an acute stage of diabetes is developing, some changes take place in the lens or the vitreous that produces a myopia, and it lasts from a few days to many weeks. A slitlamp examination during this curious focusing change has not revealed any disturbance of the tissue except occasionally the presence of edema and vesiculation of the pigment layer of the iris. This change in the iris does not disappear when the normal focus returns. The changes in the lens of badly controlled young diabetics are typical of the metabolic disorder. The diabetic amblyopia or retrobulbar neuritis of diabetes resembles that encountered in toxic amblyopia of tobacco and alcohol. The presence of these conditions in diabetes has accounted for the theory that some toxic element is distributed by the blood which is capable of damaging sometimes one or sometimes another area of the central nervous system.

True diabetes mellitus as we understand it today can be controlled by proper diet and insulin. If the diabetic shows manifestations of malnutrition, it is extremely important to supplement the well-balanced diet and insulin with some of the vitamins. Several reports have appeared, indicating that vitamin A has been beneficial to diabetics suffering from photophobia, and vitamin C has, in part, been responsible for a more rapid absorption of the various types of hemorrhages in the choroid and retina. A well-balanced diet

supplemented with a multivitamin combination and a regulated diabetic regimen will, in most instances, prevent or delay ocular manifestations associated with diabetes.

DR. KRUSE. In addition to the direct role of diabetes in nutrition, it should be remembered that in treating diabetes we in some ways produce a deficiency disease. The clinic patient used to be given diet lists with substitutions—such as, 3 Uneeda biscuits in place of certain vegetables, 4 Uneeda biscuits in place of potatoes—and when finances required these substitutions to be made, deficiency resulted. Now especially, are patients permitted to eat what they wish and the excess is covered by insulin.

Question. What is the present status of (a) blood examinations to determine vitamin deficiencies; (b) urinalyses to determine the same conditions?

DR. JOLLIFFE. At the present time, a 0.2-c.c. sample of blood can be used to determine vitamins A, C, total protein, hemoglobin, calcium, phosphorus, and one or two other factors. Urinalysis can indicate the amount of vitamin C, thiamin, and riboflavin escaping into the urine and indicate the degree of saturation of the tissues by these substances. These tests are useful in determining the recent dietary history of individual patients.

Dr. Solomon. Can these tests be used to determine the function and capacity of organs playing a role in the production and storage of these substances; as, for example, vitamin A to indicate liver function?

Dr. Jolliffe. This could be used as a liver-function test. It is likely that many doctors will use these determinations for estimating the function of various other organs.

Question. How reliable is dark adapta-

tion in determining vitamin-A deficiency?

DR. KRUSE. For technical and biological reasons it has a high degree of unreliability. Tests with three of the most widely used adaptometers showed that none of them gave a comparable curve, and that the threshold variations for different individuals were so large that a standard threshold could not be determined. There is no reason to believe that disadaptation is a sign of avitaminosis A, and there is some reason to believe that it is not.

Question. What evidence of nutritional deficiency have you observed in private practice?

DR. SOLOMON. It is undeniable that occasionally vitamin deficiency is seen in practice. We see cases of great undernourishment, with gastrocolic fistula or pyloric stenosis without evidence of specific avitaminosis. Although clear-cut vitamin deficiencies are seen, they respond well to the simple removal of the conditioning factors. Too many cases are considered so-called subclinical vitamin deficiencies. Loss of appetite, lowered work capacity, and various eye symptoms are loosely attributed to vitamin deficiency. While such patients improve with vitamin therapy, it should be remembered that every new treatment helps a neurotic. A patient with diabetic pseudotabes did not improve upon taking vitamins. Vitamins administered in a case of low-grade renal infection were without effect as regards the symptoms attributable to vitamin deficiency, but when the infection was cleared up every symptom was relieved.

DR. JOLLIFFE. Starvation does not cause vitamin deficiency. The only way to produce deficiency in animals is to starve them and then feed glucose. Asymmetrical deficiency is required for avitaminosis to present itself. When there is a con-

ditioning factor, it obviously calls for correction. The pathologic changes that have developed after years of mild deficiency are not going to be corrected by removing any factor. It will take months and years of therapy and, even then, some will be irreversible.

DR. KRUSE. Deficiencies that have been said to be widespread are not acute but are mild and so common as to have been considered normal changes. The dividing line between health and disease is not sharp and the evidence which is so great for animals has yet to be accumulated for human beings. There are several studies showing that the health of the pregnant woman and her offspring is improved by proper nutrition during pregnancy. Other studies of human beings have been made, but there must be more studies before the marked skepticism of the medical profession can be overcome.

The myopic child should not be denied a well-balanced diet supplemented by vitamins and minerals prescribed by the family doctor, but Dr. Yudkin has failed to check the advance of myopia with large amounts of vitamin D and calcium.

Question. Discuss Wernicke's central bilateral ophthalmoplegia.

DR. JOLIFFE. In this condition there is ophthalmoplegia associated with ataxia. Ophthalmoplegia, in general, may be due to many causes, but this particular syndrome will respond in a few days, and at times in hours, to fairly good doses of thiamin. The medical recovery will be very satisfactory, and there will be improvement in the ophthalmologic picture. The acute symptoms of polyneuritis, which may also be present, will disappear or be relieved. The ataxia is not changed.

Question. Discuss reversibility of ocular pathologic processes in vitamin deficiencies.

DR. KRUSE. Most stages of ocular pathologic change are reversible, although the reversal may be very slow. However, and especially in the end stages, there are actual lesions that will not be cleared up. For example, in long-standing avitaminosis A there may be destructive ulceration, corneal softening, even perforation with prolapse of the bulbar contents, and these changes are obviously not amenable to relief by diet. In general, reversibility is rapid in acute, slow in subacute, and very slow in chronic cases.

Question. In what way does organic disease bring about nutritional deficiency?

DR. SOLOMON. Examples may be cited from some abdominal cases now under treatment. A patient with gastrocolic fistula immediately eliminates, as a bowel movement, any food swallowed. A late case of periarteritis nodosa, because of circulatory impairment of the small intestine, has dysfunction with faulty absorption. Such faulty absorption also is present for similar reasons in a case of lymphoma and of tuberculous adenitis. Dr. Joliffe has given other examples in discussing conditioning factors.

Question. Has dystrophy of the cornea that occurs during the third decade or later any association with general nutritional disturbances or is it a purely local condition?

DR. YUDKIN. Dystrophies of the cornea occurring during the third decade or later are not directly associated with general nutritional disturbances nor are they a purely local condition.

The epithelial degenerations involving the epithelium and endothelium best represented by the epithelial dystrophy of Fuchs are not associated with a nutritional disturbance. The condition is probably an endothelial degeneration with subsequent epithelial involvement. Three cases of epithelial dystrophy of Fuchs

were treated with a well-balanced diet and large amounts of concentrate of vitamin-B complex for nearly four years. The vision has become worse and the bullae recur more frequently. Nodular and reticular dystrophies of the cornea are usually seen by the ophthalmologist when the condition is fairly well established in the ocular tissue. Some forms of the dystrophy have been recognized as early as during puberty.

The lesions are considered as familial and usually involve both eyes. The deposits of hyaline-like material in the superficial substantia propria may develop into a nodular type of Biber, Haab and Dimmer, or a ring-shaped type of Fleischer. There are many case reports on ocular dystrophy in the literature, and the authors almost unanimously agree that no effective treatment has been discovered, although various suggested measures have improved the condition of individual patients. The more important etiologic factors are evidence of impaired local nutrition and endocrine insufficiency, and the dystrophy may have a neurotrophic origin. With a better understanding of geriatrics, it may be possible that the aforementioned dystrophies may prove to be the result of some nutritional deficiency.

The nodular dystrophy of Salzmann has been reported as a noninflammatory and slowly progressive condition occurring in persons previously affected by phlyctenular keratitis. This condition calls to mind some experience with ocular disturbances that are still fresh in our memories. What has happened to all the cases of phlyctenular keratoconjunctivitis that were seen in the clinic annually previous to 1929? The doctrine of a well-balanced diet supplemented with cod-liver oil may be the reason why phlyctenular keratoconjunctivitis has almost entirely disappeared.

Are the fewer cases of interstitial keratitis of syphilitic and tuberculous origin which now appear annually in the clinics in this country due to fewer infections or to better resistance? In recent years there have appeared case reports wherein interstitial keratitis has been cured more rapidly by supplementing a well-regulated diet with cod-liver oil as an adjunct, some instances wherein large amounts of vitamin-B complex have accomplished the same miraculous repair to tissue, and more recently riboflavin has been given credit for rapid cure of interstitial keratitis.

Leon H. Ehrlich,
Secretary.

CHICAGO OPHTHALMOLOGICAL SOCIETY

May 21, 1945

SAMUEL J. MEYER, *president*

CLINICAL PROGRAM

(Presented by the Department of
Ophthalmology, University
of Chicago)

MALIGNANT BILATERAL EXOPHTHALMOS

DR. BARBARA SPIRO said that R. S., a white man, aged 44 years, was first seen on January 22, 1945. In May, 1944, he had had a subtotal thyroidectomy elsewhere with an uneventful recovery. About 1½ months later he noticed puffiness and protruding of both eyes, which became progressively worse in spite of the ingestion of thyroid extract. Excision of conjunctival tissue had resulted in no improvement.

When seen in the Eye Clinic in consultation, the patient's vision was: O.D. perception of hand movements at 1 foot; O.S. 20/30. The Hertel exophthalmometer reading was O.D. 35-36 mm.; O.S. 29. The conjunctivas of the right eye

were extremely injected and chemotic, and the patient was unable to close his lids. The cornea was grossly wrinkled and granular, completely devoid of epithelium in the lower half. The fundus could not be visualized. The left eye was normal except for conjunctival injection; however, it could be closed only by force. External ocular movements were almost nil in the right eye and were restricted to 10 degrees in all directions in the left eye.

A diagnosis of malignant bilateral exophthalmos with impending perforation of the right eye was made. X-ray shields were applied for protection and 1-percent atropine ointment and castor oil were applied.

On January 25, 1945, a Naffziger decompression of the right orbit was performed in the neuro-surgical department, followed by a similar procedure on the left orbit 12 days later. Following operation, the decrease of exophthalmos and chemosis was slow, and the eyes could be well closed. The cornea of the right eye cleared very slowly. About one week following the second operation, high doses of thyroid were instituted, which helped to decrease the lid edema. X-ray therapy to the pituitary was given one month following operation. The exophthalmometer reading was O.D. 18; O.S. 16. The patient was discharged about six weeks after the second operation. One month later, the vision was: O.D. perception of hand movements at 3 feet; O.S. 20/16. The patient had taken no thyroid extract for the past month and the exophthalmos was exacerbated, the Hertel reading being O.D. 22, O.S. 21. He was advised to resume the taking of thyroid extract and to continue the local prescription as well as to wear tight-fitting goggles at night.

EARLY MALIGNANT EXOPHTHALMOS

DR. BARBARA SPIRO said that Mrs. D.

L., a woman aged 32 years, presented herself at the Eye Clinic on July 5, 1944. She had had a subtotal thyroidectomy for hyperthyroidism in December, 1943, and complained that the eyes were becoming more prominent since that time. She was taking 0.5 gr. of thyroid daily. Aided vision was 20/20 bilaterally; there was mild edema of all lids and limitation of extraocular movements upward. The Hertel exophthalmometer reading was O.D. 22, O.S. 23.

X-ray studies of the skull and optic foramina showed no pathologic change. The exophthalmos slowly became worse. In December, 1944, the patient received deep X-ray therapy to the pituitary gland in addition to thyroid extract by mouth. The exophthalmos decreased somewhat immediately after irradiation, but increased subsequently to its former status. She continued to receive thyroid therapy, and the exophthalmos has remained stationary for three months.

SIDEROSIS OF THE EYEBALL?

DR. WILLIAM ROSENBERG said that L. E. H., a white man, aged 47 years, was first seen in the Eye Clinic on April 16, 1945, complaining of poor vision in the left eye and stating that the iris of the left eye had become brown. Vision was: O.D. 20/16; O.S. perception of hand movements at 8 feet, with normal light projection, color identification, and ability to visualize his vasculature entoptically. About 2½ years ago he had been struck in the eye with a steel foreign body (he believes it to have been the right eye, but his wife remembers it as the left). Vision was reduced to a "faint glow" but within a week returned to normal. About two months later, he noted central blurring and haziness of the eye, and his wife noted that the iris, previously gray, was turning brown. A dull, inconstant throbbing pain developed in the left eye. All

signs and symptoms became progressively worse, and in the summer of 1944, an ophthalmologist was consulted. Under treatment the pain and photophobia gradually decreased, but vision continued to decline. General health has been good. An X-ray study of the chest six months ago was normal.

On examination, the iris of the left eye was chocolate brown in color and muddy. The cornea grossly showed brownish pigment around the limbus. The pupil was round and did not react to stimuli, although no synechiae were present. The anterior chamber was shallow. The slit-lamp revealed fine brown pigment dispersed throughout all corneal layers, in the anterior chamber, over the anterior lens, and iris. The lens was dense and yellowish, especially nuclear. The right eye was normal; visual fields were normal. X-ray studies of the chest and skull were normal; those of the anterior segment revealed no foreign body. Biopsy specimens of the cornea and aqueous were stained with potassium-ferrocyanide for iron as well as with hematoxylin and eosin. These revealed no iron, but many fine pigment granules. In consultation, the patient saw Dr. Von der Heydt, who thought this condition was from a complicated cataract, not from a foreign body. His report stated that there was an imbibition of the cornea by cell elements which may have been blood derivatives.

CONGENITAL CATARACTS AND HIGH MYOPIA

DR. WILLIAM ROSENBERG said that E. M., a white girl, aged 12 years, was first seen on September 28, 1943, complaining of cataracts since birth. Her aided visual acuity was 20/50 in each eye, and she was able to read 6-point type with either eye. The family history was significant, in that her father and three of four siblings (two males and one female) also

had cataracts, as did her paternal grandfather and a paternal aunt. A paternal uncle was normal and had four normal children.

Except for the lens opacities the eyes were normal. Refraction under cycloplegia did not improve visual acuity. Both lenses showed a generalized pitting of the anterior surfaces, imparting a "golf ball" appearance. The anterior cortices were studded with innumerable, lustrous, crystallike opacities, most densely packed centrally. The posterior cortices were similarly involved. The fetal-Y nuclei showed moderate degrees of opacification.

No further treatment was suggested.

The father of this patient, aged 54 years, was also presented. His complaints were similar to those of his daughter except that, in the past four years, his visual acuity had diminished to such a degree that he was unable to carry on an economic existence. His visual acuity with -16.75D. spheres was 3/200 in each eye; improvement could not be obtained by refraction. Both lenses showed packed floriform, hexagonal and irregularly shaped, singular opacities, most densely aggregated axially in the adult and embryonic nuclei and becoming more sparse toward the equators. The cortices were clear, and the nuclei had a spongelike multicysted appearance. Superimposed on this, there was moderate senile nuclear sclerosis. Visual fields were normal for large targets.

Extraction of the lens of the left eye was advised, with a guarded prognosis because of the high myopia and fluid vitreous. On December 28, 1943, a combined, extracapsular lens extraction was performed. Recovery was uneventful, but a moderately dense secondary membrane remained. A needling was performed on April 1, 1944, and again recovery was uneventful. One week later the patient re-

turned, complaining of pain, redness, and photophobia. He had a severe iridocyclitis and conjunctivitis, and stated that he had returned to work the day following surgery and that it was necessary to wipe his eyes frequently. Under intensive local and foreign-protein therapy, the iridocyclitis abated, and on May 3, 1944, the aided visual acuity was 20/40, and he could read newsprint.

Two weeks later he returned, complaining of a veillike shadow over the eye that had been operated on. Examination revealed a huge temporal and inferior retinal detachment, bullous below. Vision was 20/100. He was admitted to the hospital immediately, and four days later a microcoagulation operation was performed. Convalescence was stormy, vision was reduced to light perception, and the eye began to shrink. Five weeks after surgery, the eye was definitely phthisical.

The patient and his family insisted on the extraction of the lens of the right eye subsequently and, despite a very guarded prognosis, a combined intracapsular extraction was performed on November 1, 1944. He developed a mild iridocyclitis postoperatively which responded readily to local therapy and typhoid-bacilli injections. Recovery was thereafter uneventful. Aided visual acuity with a correction of $-1.25D.$ sph. $\ominus +1.25D.$ cyl. ax. 165° is now 20/25, and he can read newsprint easily. A prosthesis was fitted to the left phthisical bulb.

CATARACT, ECTOPIA LENTIS

DR. WILLIAM ROSENBERG said that R. R. L., a white man, aged 26 years, came to the Eye Clinic on May 8, 1945. His unaided vision was O.D. 20/200; O.S. 20/70; he could read 4-point type at three inches with the left eye and 24-point with the right. Glasses were of no aid. His present condition had existed since birth, and the vision with the right eye

had always been poorer than with the left. Diagnosis of ectopic lenses and pupils had been made by several ophthalmologists, and iridectomy of the left eye had been suggested.

The right eye was 5 to 10 degrees divergent in the primary position, and he fixated with the left eye. The pupils dilated only 2 to 3 mm. eccentrically with cycloplegics and mydriatics. In the right eye, the lens edge could be visualized only obliquely so that the entire pupillary space was still filled by the lens. In the left, there was a 1-mm. slit of aphakic pupillary space nasally; the zonule could be seen stretched across this space, through which, with a $+10D.$ sph. he could read 20/50 eccentrically. The fundus of the right eye could not be visualized; that of the left appeared normal.

It was felt that an optical iridectomy on the right eye would avail nothing, whereas it might help on the left, although there was a chance of inducing monocular diplopia. On the other hand, lens extraction with iridectomy might, if uncomplicated, offer a better visual result. The right eye was probably amblyopic. It was suggested that the right eye be operated on first to determine the response to surgery and, if successful, to contemplate a similar procedure on the left eye.

ECTOPIA LENTIS

DR. WILLIAM ROSENBERG said that G. H., a $4\frac{1}{2}$ -year-old white girl, was brought to the Eye Clinic on February 3, 1945, at which time visual acuity was 20/200 in the right eye; 20/100 in the left eye. Pregnancy and birth had been normal. The present condition was observed one month after birth. At two years of age, it was noted that the eyes "glimmered," and that she held objects very close to the left eye to see them. No other symptoms were observed except that she insisted on bright lights for play, even

during the day. Her general health and development had otherwise been normal.

Examination revealed bilaterally ectopic lenses. The pupils dilated well under cycloplegia, and the aphakic portions refracted approximately $+7.00D.$ sph. $\approx +1.50D.$ cyl. ax. 90° in each eye. The fundi appeared normal. Only very narrow aphakic slits were present in the undilated state.

Lens surgery was suggested.

RIGHT LATERAL-RECTUS PARALYSIS IMPROVED BY GIFFORD OPERATION

DR. MAURICE J. DRELL said that P. B., a boy aged 11 years, was first seen in December, 1944, with a history of a fall three months previously, with questionable momentary loss of consciousness, followed by redness and swelling of the right eyelids, after which diplopia and right convergence developed.

The left eye was normal. The right eye showed a 15-degree esotropia with inability to abduct the eye past the midline; dilation, irregularity, and poor reaction of the pupil; anesthesia of the cornea with fine, diffuse, superficial staining with fluorescein; and anesthesia of the upper lid and supraorbital area. Right vision was 20/100, although it was felt that this was at least partly due to inability to fixate properly because of the internal-rectus spasm.

The findings of right abducens palsy, pupillary disturbance, and partial, fifth-nerve involvement were considered traumatic in origin. A temporal shield and nail-polish occlusion of the right glass were prescribed. When no changes were noted after three more months, recession of the internal rectus, with attachment of the outer halves of the superior and inferior recti to the external rectus, according to the technique described by Gifford, was performed in April, 1945. At present, vision with the right eye is 20/25. There

is 15 to 20 degrees of right abduction, and fusion is present at 12 degrees of convergence. Temporary prisms have been ordered.

RUBEOSIS IRIDIS, BILATERAL

DR. MAURICE J. DRELL said that D. P., an office worker, aged 48 years, was found to have diabetes of a mild nature two years ago, during a medical examination which he underwent because of failing vision. When first seen in June, 1944, his corrected vision was O.D. 20/100; O.S. 8/200. Examination revealed severe, bilateral diabetic retinopathy. The iris of the left eye was atrophic and rubeotic; that of the right eye was normal at this time. On reexamination in April, 1945, the visual acuity was essentially unchanged but the rubeosis of the left eye was more advanced, and the iris of the right eye now showed very early rubeotic change. Tension was normal. With the aid of a high plus lens for the right eye and an additional hand telescopic attachment, the patient is just able to read newspaper at six inches. He has been taking lemon juice in an effort to halt the progression of the vascular changes. In view of the poor prognosis of the progressive retinopathy, he has begun the study of Braille.

OPHTHALMIC MIGRAINE

DR. MAURICE J. DRELL said that C. B., a woman, aged 24 years, consulted the Clinic in January, 1945, with a history of pain in the right eye and diminution of vision in both eyes since March, 1944. Associated with this there have been photophobia, considerable watering, and some redness of the right eye. Vision O.D. was 20/200; O.S. 20/40. There was a moderate ptosis of the right eyelid, and a mild ptosis of the left. No corneal sensation was felt in the right eye, and there was definite hypesthesia of the upper two

thirds of the right side of the face and tongue. The cornea showed scattered fine staining with fluorescein. Field studies, skull and optic-foramen X-ray studies, routine laboratory procedures, and neurologic consultation gave no findings of significance. An audiogram showed bilateral slight hearing loss.

In view of the right corneal anesthesia, glasses with temporal shields were ordered, and an effort was made to control the pain with salicylates. The use of X-ray therapy to the Gasserian ganglion has been considered, but in as much as this treatment has been found to aggravate the pain almost as frequently as it affords relief, such therapy has been deferred thus far.

HEMORRHAGIC GLAUCOMA AND RUBEOSIS IRIDIS

DR. MAURICE J. DRELL said that Mr. W. C., a man, aged 73 years, was first seen one month ago, with a history of blurring of vision with the left eye commencing in August, 1944. Several months later the vision with the right eye in the nasal part of the field also became blurred. There was no pain. Three months ago the vision with the right eye became much worse, and for two weeks preceding his first visit the right eye was extremely and constantly painful. Vision was: O.D. light perception only; O.S. 20/50, with the best correction. The right eye was markedly injected, very firm tactily, and the cornea was moderately edematous. Through the edematous cornea, a dilated, atrophic, rubeotic iris was seen. The fundus could not be seen. In the left eye the essential findings were: advanced sclerosis of the retinal vessels and degenerative macular disease. Tension was O.D. 61 mm. Hg (Schiotz); O.S. 16 mm. Hg. Intensive application of pilocarpine and eserine completely relieved the pain in the right eye and caused the corneal edema to

subside, although tension has never dropped below 35.5 mm. Hg (Schiotz).

Laboratory investigation, including fasting, blood-sugar, and glucose-tolerance tests, revealed nothing of significance other than a mild secondary anemia.

TOXIC AMBLYOPIA (TOBACCO AND ALCOHOL)

DR. MAURICE J. DRELL said that G. S., a toolmaker aged 33 years, was first seen in August, 1944, with a 3-months' history of progressively lowered vision which had reached the point where he was unable to continue work. His best vision at the time was O.D. 15/200; O.S. 20/100. He had been smoking two packages of cigarettes and drinking several bottles of beer as well as a moderate amount of whiskey daily. Field studies revealed a typical centrocecal scotoma in the right eye and a paramacular relative scotoma in the left eye. He was placed on massive doses of B complex, orally and parenterally, and showed no improvement for five months. After this time, he began to improve slowly so that by February vision was O.U. 20/20. In May, vision was: O.U. 20/16. Field studies still revealed small relative scotomas in the papillomacular area, but these were shrinking steadily. He has been back at work for several months. The diagnosis was toxic amblyopia caused by alcohol and tobacco.

BILATERAL IRITIS DUE TO SARCOIDOSIS

DR. C. KEITH BARNES said that Mrs. A. S., aged 58 years, has been under observation and therapy at the Billings Chest Clinic for pulmonary sarcoidosis for many years. She has also had a chronic, bilateral iritis and keratoconjunctivitis which has been studied in the Eye Clinic. Because the etiologic studies have been negative in all other respects, it is believed that the ocular pathologic lesions may be attributed to the sarcoidosis.

She exhibits rather striking brushlike cyclitic membranes of the pupillary spaces. The fundi are seen reasonably well and show no gross pathologic change.

EXOPHTHALMOS DUE TO RETROBULBAR METASTASIS OF PULMONARY CARCINOMA

DR. C. KEITH BARNES said that C. F., a white man, aged 40 years, came to the Clinic because the left eye had been swollen for four or five weeks. He was seen elsewhere in 1932, when bilateral cataract was diagnosed. His past history included the following items of significance. Twenty-five years ago, he had a five-story fall and suffered a skull fracture. There were no subsequent eye findings. The right arm was amputated at that time. He was told that he had a spontaneous pneumothorax two months ago. He had lost about 20 pounds in 18 months. He coughed frequently.

The major eye findings, in addition to bilateral nuclear cataracts, were as follows: The left eyeball was proptosed 9 mm. forward and 7 mm. downward, with adequate lid closure. Left extraocular movements were markedly reduced in all directions. A firm fixed mass could be palpated above the left globe. No bruit nor pulsation was present; the mass did not increase with jugular compression nor decrease with carotid compression. Through the peripheries of dilated pupils, the fundi appeared normal except for engorgement of the veins and constriction of the arteries of the retina of the left eye.

Pertinent general findings were: Wassermann test was negative. Skull X-ray studies were negative. On the chest film there was a uniform, markedly increased density involving the whole left side of the chest so that even rib shadows could barely be made out. The shift of the mediastinum to the left indicated that pul-

monary atelectasis, as well as pleural effusion, probably played a part in producing this picture. A biopsy specimen has not been taken of the orbital mass, but it is believed that mitotic figures would be demonstrated.

Robert Von der Heydt.

ROYAL SOCIETY OF MEDICINE

SECTION OF OPHTHALMOLOGY

June 8, 1945

MR. P. E. H. ADAMS, *president*

Abstracted by permission from the Proceedings of the Royal Society of Medicine (Section of Ophthalmology), 1945, volume 38, number 4, sectional page 35.

UNUSUAL INTRAOCULAR FOREIGN BODIES

MAJOR C. DEE SHAPLAND presented two cases showing unusual intraocular foreign bodies.

Case 1. A sergeant was wounded on May 28, 1940, by a bullet splash from an enemy machine gun on the armored vehicle in which he was travelling. When hit, he saw a flash in front of his face and felt pain in his left eye. He was transferred to a Casualty Clearing Station, and while there was captured by the Germans. On July 23, 1940, he was discharged from hospital and received no further treatment during his long period of captivity. The patient stated that he had been "blind" in his left eye since the injury. He was repatriated on May 11, 1945, and was first seen by Major Shapland at Millbank on May 23, 1945.

The left eye showed a divergent squint of some 10 degrees, no active inflammatory signs, and there was an anterior iritic synechia to a perforating, corneal scar paracentrally at the 7-o'clock position. There were multiple, minute, glistening,

metallic fragments on the iris and in the iris stroma, especially below, where there was a ragged, narrow, complete iridectomy; the eye was aphakic with dense capsule, and there was no fundus reflex. The tension was normal, and vision was reduced to perception of light with good projection. The right eye showed no abnormality and had standard vision unaided.

On May 24, 1945, the left eye was put up to a giant magnet with a negative result, and immediately afterward the anterior synechia was divided with a Ziegler knife under local anesthesia and, at the same time, a capsulotomy was performed. The eye settled down uneventfully from the operation, and its vision is now 6/12 with aphakic correction (+12.50D. sph.)

The interest of this case was the fact that the injured eye, despite the presence of multiple nonmagnetic metallic fragments on and in the iris stroma for five years showed no active inflammatory signs nor evidence of degeneration resulting from chemical action. The nature of the intraocular metal must necessarily be a matter of speculation but was presumably derived from the German machine-gun bullet and was, therefore, probably a lead-nickel alloy.

Case 2. A captain, while examining a German underground cable by a roadside in Normandy, on June 17, 1944, pulled a piece of cord, and an explosion occurred. He was taken to No. 21 Field Dressing Station with multiple wounds of the face and hands and injuries to both eyes.

His face was much pitted and scarred from multiple fragments of stone of all sizes up to that of a large pea. The smaller fragments were quite superficial and were constantly being spontaneously extruded, the larger ones were deeper and were removed later from the mucous surface of both upper and lower lids, from

the plane of the orbicularis oculi in the left upper lid and just superficial to bone in the right frontal region.

The right eye showed considerable conjunctival and ciliary injection; small particles of stone in the sclera some 2 mm. from the limbus at the 9-o'clock position; slight superficial corneal scarring; no K.P.'s; mydriasis (atropine); fundus normal; tension normal; vision 6/24 unaided. On the left side there was very considerable blepharospasm and photophobia; the eye showed much conjunctival and ciliary injection; many minute particles of stone embedded in the sclera mainly adjacent to the limbus at the 3- and the 9-o'clock position; multiple perforating corneal scars; numerous minute foreign bodies on and in the iris stroma; pupil half dilated and fixed (atropine) with a firm posterior synechia at the 12-o'clock position; a traumatic cataract with central perforation in the lens capsule and lens matter extruding into the anterior chamber; a faint reflex with no fundus details; tension normal; vision perception of light with good projection.

The right eye was put on 1-percent atropine drops twice daily; the left eye on 1-percent atropine ointment, with hot bathings every four hours and penicillin drops (500 units /c.c.), two-hourly by day. On July 9, 1944, the radiologist reported that there were no opaque intra-orbital foreign bodies in either the right or the left eye, and on the same day, the left eye gave a negative response to the giant magnet. By July 18th, the eyes had become sufficiently quiet to allow removal of several particles of stone embedded in the sclera and episclera of both eyes.

The right eye was taken off atropine on October 1, 1944, but the left eye remained irritable for many weeks longer and at one stage developed fine K.P.'s with inflammatory cells in the anterior chamber. It became quiet eventually, how-

ever, and the patient was discharged from the hospital on November 5, 1944, with the right eye white, and vision 6/5 unaided. The left eye was quiet, with no K.P.'s and normal tension; the lens, however, was almost completely opaque; and vision was sufficient for counting fingers at six inches with good projection.

The interest of this case was the presence of multiple particles of stone intraocularly with the absence of pyogenic infection. In civil life, in my experience, an intraocular foreign body of stone is usually rapidly followed by the loss of the injured eye from panophthalmitis. Presumably the disruptive effect of the high explosive was sufficient so to disintegrate the road stones as to render them sterile. The patient received no systemic penicillin; but did have a course of sulfadiazine, a total of 20 gm. being given between June 22 and 27, 1944. The traumatic cataract in the left eye was needled. The eye is now aphakic, and central vision with correction is 6/12. The particles of stone in the iris stroma appeared unchanged, and the eye stood the needling quite well.

MYASTHENIA GRAVIS SHOWING RECURRENT MONOCULAR PARALYTIC MANIFESTATIONS

MR. SIMON BEHRMAN presented such a case in a woman. He said that, excepting for the paralytic phenomena, this patient remained throughout the period under review in excellent health and complained of no other myasthenic phenomena.

General medical, serologic, and neurologic examinations remained negative, apart from the oculomotor paralysis which, although subject to fluctuations, showed none of the diurnal variations characteristic of myasthenia gravis. Blood Wassermann reaction and the pupillary reactions have remained normal through-

out. The paralysis could be relieved rapidly and almost completely by diagnostic injection of prostigmine.

For treatment, oral administration of prostigmine was used. She made an almost complete recovery, and now shows only a slight paresis of the left superior rectus muscle.

EXOPHTHALMOS FOLLOWING ABRUPT DISCONTINUATION OF THYROID MEDICATION FOR OBESITY

MR. SIMON BEHRMAN presented the case of a woman, aged 48 years, who in 1935, after six months' treatment, "left off taking thyroid because a sister, who was also taking thyroid, became a wreck." This patient's eyes then became prominent, and she later received deep X-ray treatment on account of "thyroid trouble," with marked success. She now complains that she is putting on weight and that there is puffiness under the eyes. There is absence of lid retraction; the presence of exophthalmos is indicated by the exposure of the sclera below the lower border of the iris. Some puffiness is present around both eyes. She shows obesity, but otherwise her health remains good, and she is able to earn her livelihood as a driver of a delivery van.

Comment. Administration of thyroxine or thyroid extract does not lead to exophthalmos, except in a few cases. The rarity of this event in man can be gauged from the fact that Russell Brain (*Lancet*, 1936, v. 1, p. 182) was unable to find more than 20 instances in the literature. The present case resembles one of those included by him in his series. The case was originally reported by Stegman in 1906. After thyroid treatment, the patient developed palpitations and this led to the discontinuation of treatment. During the next few months, tachycardia, tremor, diarrhea, and loss of weight became conspicuous, and later exophthalmos ap-

peared. The condition of the patient improved greatly following deep X-ray treatment.

It would seem that administration of thyroid extract in a certain number of patients initiates a condition closely resembling, if not identical with, exophthalmic goiter.

EXOPHTHALMOS AND ENDOCRINE DISTURBANCE

DR. W. RUSSELL BRAIN opened the discussion on the subject. He said that the syndrome which he has called exophthalmic ophthalmoplegia is characterized by exophthalmos, external ophthalmoplegia, chemosis, swelling of the eyelids, and, in severe cases, papilledema. The puzzling feature in its etiology is that such a clinical picture may be associated with (1) thyrotoxicosis, (2) myxedema, or (3) a normal state of thyroid function. Two conflicting solutions of this problem have been proposed by British workers. Mulvany (1944) believes that there are really two forms of exophthalmos, which he calls thyrotoxic and thyrotropic exophthalmos. In his view, not only is their mode of production different, but the accompanying ophthalmoplegia is of different origin in the two forms. He attributes thyrotoxic exophthalmos to contraction of the orbital smooth muscles secondary to sympathicotonia, and the ophthalmoplegia to a myopathic condition of the ocular muscles, swelling of which causes the exophthalmos.

Rundle and Pochin (1944), on the other hand, maintain that exophthalmos in Graves's disease is due to an increase in bulk of the retroocular tissues. They claim to have shown that this increase is due to fat and is greatest in the eye muscles, in which the average fat content was doubled in a series of 17 thyrotoxic cases. Further, Rundle and Wilson (1944) state the bulging of the eyelids

associated with severe exophthalmos is not due to edema of the palpebral tissues, but to protrusion of the orbital fat increased in bulk. The same authors (1944) have carefully measured the ocular movements in cases of thyrotoxicosis and in patients with postthyroidectomy exophthalmos. In the former group, weakness of ocular movement is both less frequent and less severe than in the latter, but they believe it differs only in severity and not in kind. They note that in thyrotoxicosis, ophthalmoplegia may sometimes occur without exophthalmos, and they seem to attribute it to, or at any rate correlate it with, the increased fat content of the ocular muscles. They believe, then, that there is no difference in kind between the two forms, merely noting that there is an inverse relationship between thyrotoxicosis and ophthalmoplegia in Graves's disease. They propose to distinguish two forms of Graves's disease, an ophthalmic form without thyrotoxicosis, and a thyrotoxic form.

Clearly this view is unsatisfactory, for if the ophthalmoplegia is due to increased fat caused by the thyrotoxicosis, what can be the cause of it in the nonthyrotoxic cases? Either in both groups there is some common cause which is not thyrotoxicosis, or there are two causes—thyrotoxicosis in one group and something else in the other.

There is no considerable evidence in favor of thyrotoxic exophthalmos and ophthalmoplegia, however thyrotoxicosis may operate. In addition to the work I have quoted, there is some evidence that exophthalmos may be produced by the administration of thyroid extract and disappear on its withdrawal (Brain, 1936). There is also the improvement in both exophthalmos and ophthalmoplegia which sometimes follows thyroidectomy, or the administration of thiouracil. But neither exophthalmos nor ophthalmoplegia is

usually severe in thyrotoxicosis, except, perhaps in older patients.

What is the evidence for thyrotropic exophthalmos and ophthalmoplegia? There is a considerable volume of experimental work which shows that exophthalmos can be produced in guinea pigs by the thyrotropic hormone of the pituitary. Recent work has shown that this is due to edema of the orbital tissues (Smelser, 1943; Pochin, 1944); and Aird (1940) has reported histologic changes in the ocular muscles of the experimental animal similar to those found in exophthalmic ophthalmoplegia in man. This, of course, does not prove that exophthalmic ophthalmoplegia occurring in the absence of thyrotoxicosis is due to a thyrotropic hormone of the pituitary, but it does seem to be established that that hormone can produce a similar picture in animals and does so by means of orbital changes distinct from those obtaining in thyrotoxicosis. There is thus, in animals at least, and probably in man, evidence favoring both thyrotoxic and thyrotropic exophthalmic ophthalmoplegia. The failure to distinguish different causes for what appears to be the same ocular disturbance would explain some apparently conflicting results of treatment. Thiouracil or thyroidectomy would benefit the patient with the thyrotoxic form, though both can help to cause the syndrome in another way. Thyroid extract could hardly improve the patient already thyrotoxic but might well help one whose exophthalmos was associated with myxedema or rapid gain in weight; while either ovarian or testicular or thyroid extract might improve the exophthalmos due to the thyrotropic hormone, by inhibiting the production of this hormone by the pituitary.

Dr. Brain also said that since he had published an earlier paper (1937), he had seen 30 more cases, making 61 in all. The sexes are equally affected, and the av-

erage age is 50. Out of 61 cases, the condition followed thyroidectomy in only 11 and thiouracil in 1. In the postthyroidectomy group, males are affected at least four times as often as females. Since females get hyperthyroidism 9 times as often as males, males are 36 times more likely than females to get exophthalmic ophthalmoplegia after thyroidectomy for thyrotoxicosis. This striking sex difference seems to favor an endocrine factor in etiology rather than mere increase in weight or myxedema.

For treatment, Dr. Brain said that he had chiefly used estrin for both sexes. The results are mostly disappointing, occasionally very good. Most patients improve up to a point. He had increased the dose up to 20 mg. of stilbestrol daily in some cases.

EXOPHTHALMIC OPHTHALMOPLÉGIA AND ITS RELATION TO THYROTOXICOSIS

PROF. IDA MANN gave a paper on this subject which has been published in the *Journal* (June, 1946).

Discussion. Dr. S. Leonard Simpson said that he would like for a moment to depart from a close view of the end-results of illness, and urge how very much might be done by a prophylactic psychiatric approach to the problem. Anxiety and shock play an etiologic part both in thyrotoxicosis and in exophthalmic ophthalmoplegia. This is also true of duodenal ulcer, effort syndrome (D. A. H.) and some forms of hypertension, from which it appears that the nature of the derangement depends very much upon which organs or tissues of an individual are susceptible to the stimuli which come from the hypothalamus and perhaps from the pituitary. Are we not looking at the end-results of a psychogenic-hypothalamic syndrome?

Experimental evidence indicated that the thyrotropic hormone alone produced

exophthalmos, and although thyroxine might augment this effect, he did not believe that thyroxine alone could produce exophthalmos in man as distinct from lid retraction. Theoretically, withdrawal of thyroxine could, as a release phenomenon, produce the secretion of thyrotropic hormone, but he had seen many hundreds of cases of people who had had very large doses of thyroxine, producing sweating and tachycardia, and he had never himself seen—although a few cases had been reported—exophthalmos of any severity produced by thyroxine alone.

Concerning the group which Dr. Brain had separated, one must remember that the ophthalmoplegia was not necessarily present in the early part of the syndrome, so that there was a gradual transition from exophthalmos to exophthalmic ophthalmoplegia. The group looked different, the age was different, and the sex incidence (predominantly male) was different.

He would suggest the following theory: If it was accepted that the pituitary thyrotropic hormone produced exophthalmos, both in Graves's disease and in the exophthalmic ophthalmoplegic group, in the latter the thyroid was incapable of responding to the thyrotropic hormone. This was not improbable on clinical grounds. First of all, there was the age of the patients to be taken into consideration—about 50 years—and although one could get Graves's disease in old people, it was much rarer; then, again, the bulk of the cases was in men, in whom the thyroid was much less labile than in women. The theory could be put to the test by injecting these people with thyrotropic hormone, and seeing if a raising of the basal-metabolism rate was induced. The theory certainly appeared to apply to that type of exophthalmic ophthalmoplegia which followed extensive thyroidectomy, and which was as-

sociated with a low metabolic rate.

It was recognized clinically that toxic adenoma as distinct from Graves's disease was associated with minimal eye change, and rarely recurred after thyroidectomy. The reason for that would be that in the toxic adenomas it was not the thyrotropic hormone that was operating, but the primary activity of the thyroid gland. This was quite comparable with other endocrine diseases. Thus one might have either a single nonrecurrent cystic ovary, or multiple cystic ovaries which regenerated after one ovary had been removed and part of the other. The same held good for the adrenal glands.

He thought that testosterone was more logical for use in men than estradiol, which was more logical in women. Testosterone was as likely to inhibit the pituitary as was estradiol, and massive estradiol therapy was associated with retention of fluid. Neither hormones nor deep pituitary radiation could produce satisfactory results where irreversible secondary changes had taken place in the orbit.

Mr. E. E. Pochin referred to some of the quantitative data that he had obtained with Mr. Rundle. They had examined a series of 17 cases of thyrotoxicosis coming to necropsy, including 6 diagnosed as having exophthalmos, and had made a complete removal and analysis of the orbital contents. Where present, the exophthalmos had been of the simple type common in Graves's disease and not the so-called "malignant" or severe form.

It was found that the bulk of the orbital tissues was increased by an amount corresponding to the displacement of the eye observed in these cases. The increase was due to an excess of fat in the orbital structures, affecting particularly the skeletal eye muscles in which this ether-extract component was more than doubled. It was of significance that this change in the eye muscles was found in

15 of the 17 cases and not merely in those with exophthalmos.

In the light of these findings, what was the probable relationship between simple and "malignant" exophthalmos? It has now been shown that in simple exophthalmos, orbital tissues and particularly muscles were increased in bulk. In addition the careful work of Rundle and Wilson on ophthalmoplegia in thyrotoxic subjects, which his own measurements fully supported, showed limitation of ocular movement also to be frequent in simple exophthalmos. It thus appeared that each of these phenomena occurred in mild degree in mild or simple exophthalmos, and more severely in severe or "malignant" exophthalmos. Was "malignant" exophthalmos merely a more advanced, and secondarily complicated stage of simple exophthalmos?

He would suggest one hypothesis which was very far from being proved but which might provoke investigation. It was possible that, as orbital-tissue bulk increased in simple exophthalmos, a stage of severity was reached at which the vascular drainage of the orbit was mechanically impeded. The added orbital

bulk then started the rapid progression of malignant exophthalmos. with its severe protrusion, clinical evidence of congestions, and post-mortem findings of edema and later fibrosis. On this view it seemed likely that any rapid gain in body weight, such as might follow thyroidectomy, could in an exophthalmic subject increase the bulk of the orbital tissues enough to tip the scale and precipitate the progressive changes of "malignant" exophthalmos.

Prof. Ida Mann said that orbital decompression had not been done in any of her series (see the June, 1946, issue of this Journal). She knew that Mulvany had stated that if one had to deal with the malignant type one must perform Naffziger's operation to save the eye, but she thought she had shown that tarsorrhaphy plus the administration of thyroid extract did save the eye without this. Orbital decompression was, of course, a grave operation whereas tarsorrhaphy was not; in any case, with proper endocrine treatment the condition should subside, and the large mutilating operation of removing the orbital roof should not be necessary.

THE DEPARTMENT OF SOCIETY PROCEEDINGS WOULD LIKE TO OBTAIN THE SERVICES OF ONE WHO CAN TRANSLATE (AND ABSTRACT) SPANISH CONTRIBUTIONS. PLEASE WRITE
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AMERICAN JOURNAL OF OPHTHALMOLOGY

Published Monthly by the Ophthalmic Publishing Company

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THE 1946 SPRING OPHTHALMIC MEETINGS

Many noteworthy events occurred during the delightful concentrated dose of ophthalmic and general meetings held in San Francisco from June 26th to July 5th, to make this a most enjoyable and fruitful occasion. The very lovely and unique city of San Francisco put on its most heavenly weather, for the sky was unreasonably blue, the sun was always there, and fog was conspicuous by its absence. There was an aura of relaxation, peace, and good fellowship, accentuated

by a short trolley strike, surrounding the visitor and native alike. Our San Francisco colleagues combined remarkable efficiency with hard work in their local committees with pleasurable and gracious hospitality. Many ex-medical officers attended their first post-war meetings and were obviously hungry for the varied ophthalmic fare spread before them. It was good to have them back with us once more. The chief leaven or ferment was the presence of Sir Stewart and Lady Duke-Elder of London. Sir Stewart, fresh from Northwestern University

where he had just received the honorary degree of Doctor of Science, radiated bouncing energy and friendly good nature. Gracious Lady Duke-Elder quickly won the affection of all of us and of our own ladies, too. They were guests of honor of the American Ophthalmological Society, which presented Sir Stewart, on June 27th, with the Howe medal for distinguished service to ophthalmology and elected him to honorary membership. The American Medical Association likewise made him an honorary member, and the Association for Research in Ophthalmology went one step better and elected both of them to honorary memberships, for Lady Duke-Elder is an ophthalmologist of distinction in her own right. All of these honors were graciously and modestly received and unanimously applauded. It is unnecessary to add that Sir Stewart and his Lady were the hit of the whole show, and all of us had many opportunities to meet and get to know these delightful people whom we now feel to be truly one of us.

The American Ophthalmological Society opened the events on June 25th. The scientific program was, on the whole, excellent and thought provoking. It is always difficult to single out the outstanding papers of this Society. The program offered much variety so that individual interests were well satisfied. The paper by Atkinson and Von Sollmann on "Mercury in the lens;" by Haden on the "Development of ectodermal framework of the optic nerve;" by McLean and Brambel on "Dicumarol and rutin in retinal vascular disorders," and by Berke on "Tenotomy of the superior oblique muscle within its sheath," seemed to this reporter to be particularly meritorious. Sir Stewart gave as his address a brilliant philosophical discussion of "Ophthalmology during the war, and in the future" that closed with the thought-provoking remark that it is up to the United States to keep the

torch of ophthalmology alight until Great Britain and the European continent have a breathing spell in which to recover, an event that may require several decades. The idea behind Parker Heath's paper on "Ophthalmic assistance at professional level," promoting the idea of ophthalmic technicians, trained at the university level and by medical teachers, was unanimously approved by the Society. This somewhat revolutionary and certainly evolutionary concept, if carried out, will prove to be a great boon to the ophthalmologist charged with the responsibility of professional eye care to the people, to industry, and to the Armed Forces.

John W. Burke of Washington, D.C., was elected president, Henry C. Haden of Houston, vice president, and Walter S. Atkinson of Watertown, N.Y., secretary and treasurer. Eighty-five members and 99 guests registered. The next meeting will be in Hot Springs, June 4, 5, 6, 1947.

On Tuesday, July 2d, the Association for Research in Ophthalmology held its 15th Scientific Meeting. As is customary, eight papers of research nature were presented. The program was excellent and well received. The field of ophthalmic research is rapidly growing, and the Association is gradually coming into its own, although its growth is hampered to some extent by the fact that so few nonmedical research workers in ophthalmology have joined, although they are entitled to belong and are assured of a hearty welcome by all members. Efforts should be made to enroll these individuals who are so necessary to ophthalmology and encourage them to take an active part in the guidance of this Association.

The Section on Ophthalmology of the American Medical Association held its scientific sessions in the mornings of July 3d and 4th, and combined with the Section on Nervous and Mental Diseases on July 5th as a joint session; 225 members

were registered. Under the very able direction of its chairman, Frederick C. Cordes of San Francisco, the Section program contained many papers of note and value. The chairman's address on "Ophthalmology's postwar responsibilities and opportunities" discussed the urgent problem of postgraduate training in ophthalmology and contained many constructive ideas. The guest of honor of the Section was Vice-Admiral Ross T. McIntire (MC) U.S.N., whose blue and brass uniform gave a scintillating color to the platform for the short time that he remained with the Section. The title of his paper "The role of ophthalmology in the Navy during wartimes" does not cover the full scope of his address, for the future of ophthalmology in the Navy was, in the opinion of this editor, the most important part of his talk. Admiral McIntire blamed what shortcomings ophthalmology in the Navy incurred upon poorly trained ophthalmic surgeons. He did not touch, of course, on the failure of the Navy personnel office to place the well-trained ophthalmologists in strategic positions where they could do the most good. Nor did he mention the fact that there was no consulting ophthalmologist in the Bureau of Medicine or Surgery of the Navy, who might have been of great assistance in the very great difficulty of proper assignment. But the future of ophthalmology in the Navy, if Admiral McIntire's schemes are fulfilled, should be particularly bright and encouraging to our great and important specialty without which neither the Army nor Navy Medical Corps can carry out their obligations for the proper professional care of the sick and wounded.

The scientific program was unusually good, especially when one considers the difficulties of assembling a program under these postwar conditions. There were several new ideas presented. Swan's paper on "Esotropia following occlusion"

focused attention on a condition that can be both annoying and embarrassing; Chandler's paper on a "Neglected cause of secondary glaucoma in eyes in which the lens is absent or dislocated" brought out a new thought; namely, that aphakic glaucoma may be due to a block between the posterior and anterior chambers. He showed pretty conclusively that iridectomy or iris transfixion cures this trouble. Barkan's paper on "Congenital glaucoma" gave impressive evidence that the operation of goniotomy which he devised, is of great value and is probably here to stay. Kuhn's paper on "Industrial ophthalmology" outlined the overwhelming field of work in this specialty and focused our attention on the problem of answering the increasing clamor of Industry for ophthalmic help. The other papers likewise deserve to be singled out for mention, but space does not permit. The able secretary of the Section did a commendable job in presenting to us such a splendid menu of ophthalmic fare.

The moving-picture program contained several items of ophthalmic interest and was well attended.

The Section was represented in the scientific exhibits by five noteworthy exhibits. Lack of space prevented more being shown. The splendid exhibit of A. D. Ruedemann of Cleveland, Ohio, on "A permanent plastic eye" was awarded one of the few gold medals (Class I) by the American Medical Association for originality and excellence of presentation. This award, so richly deserved, is a matter of great satisfaction to the Section.

The Section without a dissenting voice or vote adopted a resolution declaring it ethical for a doctor of medicine to lecture to or instruct nonmedical groups or individuals on matters that are pertinent to the prevention of blindness or important to the visual health and welfare of the people.

It was a matter of great regret to all

members of the Section that its vice-chairman, Grady Clay of Atlanta, was unable to be present because of illness. A message of affection, esteem, and sorrow was officially sent to Dr. Clay by the Section.

The officers elected for the 1947 Session were Derrick Vail, Chicago, chairman; Warren D. Horner, San Francisco, vice-chairman, and Trygve Gundersen, Boston, assistant secretary. Dr. Robert Masters, Indianapolis, continues as secretary. The next meeting will be held in Atlantic City, N.J., on June 8th and will celebrate the 100th anniversary of the founding of the American Medical Association. It promises to be a gala event and a magnificent performance.

Derrick Vail.

THEORIES CONCERNING MYOPIA

In the garden of ophthalmic science the problem of the causation of myopia is a hardy perennial. Whether presented before specialists or general physicians, the subject usually draws an audience. It is also a fertile field for editorial comment!

For many years the belief that close work or study was largely responsible for the production of myopia held almost undisputed sway. The more recent tendency, however, has been to regard refractive errors as dependent chiefly upon heredity. This point of view has greatly modified our attitude toward the myopic school child. The late Harrison Butler, prominent English writer on refraction, felt that the near-work theory had caused considerable injustice to myopes, whose ocular defect had often prevented their holding scholarships or becoming teachers. Sorsby considers nearsightedness as a problem in biology, and interprets low and medium myopia as a "nonpathologic and nonpathogenic variation."

In a recent paper, Lindner (Klinische

Medizin, Vienna, 1946, part 1) writes as a very stalwart adherent of the view that close work plays a most significant part in development of myopia. He rigorously decries the tendency of recent handbooks, especially those dealing with heredity, to explain lengthening of the eyeball in myopia as due, not to stretching, but to the hereditary influence of growth.

Unfortunately for all the disputants, and especially for those who are disposed to be dogmatic as to the influence of near work upon the development of myopia, the bases for discussion are so relatively obscure, and hereditary and environmental influences so complicated, that final and infallible scientific conclusions are well-nigh impossible. In spite of a certain German ruler now probably defunct, all civilized peoples of the world have undergone so much hybridization as greatly to complicate the study of their heredity. The more confused the mongrel's descent the more difficult its analysis.

An attempt to study the problem in a primitive people that has undergone very little mixture with other races was made some years ago by Stig Holm (see editorial, *American Journal of Ophthalmology*, 1938, volume 21, page 680). Holm's material was found among the inhabitants of Gaboon, French Equatorial Africa, who belong to one of the most ancient strains of the Negro race. These natives showed tendencies in ocular refraction, from childhood to old age, more or less parallel with those found among the civilized nations of the world. On the whole, the refractive variations were less conspicuous than among civilized communities.

Generally speaking, hybridization makes for variability in the descendants. According to the anthropologists Keith and Bolk, primitive peoples display a quality called "infantilism," as opposed to the quality of "progressivity" which accompanies the mixing of breeds. High myopia and other

extreme refractive errors are explained by certain authors including Holm as representing morbid or exaggerated manifestations of the "progressive" quality of variability.

Lindner has developed his own anatomic explanation for the scleral stretching found in association with marked degrees of myopia. Obviously, this stretching does not depend upon increased tension of the eyeball. But it has frequently been blamed upon yielding of the sclera to normal ocular pressure, a yielding which becomes greater as we approach the macular region. How, asks Lindner, does this thinning process develop?

Heine is quoted as having shown, by anatomic study in high unilateral myopia, that the much larger, highly myopic, eye contained a smaller mass of scleral tissue than the normal eye. Lindner points to the frequency with which, in the areas of greater scleral stretching, there may be seen so-called "varnish cracks," corresponding to breaks in the lamina vitrea, analogous to the gaps associated with stretching of Descemet's membrane.

Connective tissue, says Lindner further, is softened by inflammation, being digested by ferments arising partly from the blood serum and partly from the white blood cells. This process, he argues, may develop from simple congestion without inflammation, by reason of the toxic effect of carbonic-acid gas, aided by a certain amount of blood serum exuded from the capillaries. The process would be further emphasized by any damage to the capillaries.

Lindner is disposed to believe that in high myopia not attributable to excessive retinal labor, there is a deficiency in amount of nutrient protection of the macular region, and of the retina generally, normally furnished by the densely packed capillary network of the choriocapillaris. He admits that even in very high myopia the retina of the macular

region shows very little stretching, but explains greater stretching in the periphery on the ground of a lesser capacity for resistance there!

Lindner's complicated theory calls for one qualifying explanation after another. He explains the lower incidence of myopia in the United States on the ground that school study is less exacting among American children. But, he says, we in the United States have a greater incidence of late myopia, on account of greater intensity of study in college. He quotes from Nowak the record of a family in which both parents, immigrated from Europe, were high myopes but their nine children showed no myopia; yet, ignoring the caprices of heredity, he is disposed to explain this record on the basis of modified conditions of living and study in the United States!

One wonders what happens to the nutrient control of the choriocapillaris in those numerous cases of high myopia in vigorous and well-built American high-school children addicted to swimming and other sports, and living in country towns under excellent climatic and nutritional conditions.

In considering the problem of myopia, it may be well to assume that not the single element of heredity, not nutrition alone, not the influence merely of study or other close work, but all three factors jointly and in varying degree, may be responsible for the anomalous optical measurements of myopic eyes. The greatest practical benefits are likely to be derived from consideration of every detail presented by the individual patient.

W. H. Crisp.

WILMER RESIDENTS ASSOCIATION MEETING

The fifth clinical meeting of the Residents Association of the Wilmer Institute was held in Baltimore, in the Wilmer

Institute of the Johns Hopkins Hospital, on April 25th to 27th.

This Residents Association is composed solely of the men who have held the position of Resident Ophthalmologist in the Johns Hopkins Hospital. The Wilmer Institute was founded in 1925 when the first Resident Ophthalmologist was appointed. There are now 21 men who have held this position. It represents the final appointment of five resident years' service on the Institute staff, beginning as a House Officer, and progressing through junior and senior Assistant Residences until the Resident is finally selected for appointment from his group. The Residents Association therefore represents a cross section of activities of the Wilmer Institute from its founding to the present time.

The Association was organized as such in 1937, when the first formal meeting was held. The original purpose of the meeting was to provide an opportunity for reunion of Residents and other alumni of the Institute and to present to them a review of the various activities of the Institute during the preceding year. To this end the meetings are partly social and partly scientific. At the first meeting, a few ophthalmologists from neighboring cities were invited as guests of the Residents Association. The number of such guests increased each year, until the meetings were suspended during the war. The recent fifth meeting is the first one held since 1941. Twenty of the 21 members of the Residents Association were present, together with a number of other alumni, old Assistant Residents and Internes, and approximately one hundred out-of-town guest ophthalmologists.

The scientific program was held Thursday and Friday, mornings and afternoons, and on Saturday morning. Luncheons were served in the library of the Wilmer Institute. A general buffet supper was held Thursday night, and various in-

formal dinners were held Friday evening. After the adjournment of the meeting, the Residents' dinner was held Saturday night.

The scientific program consisted of papers presented by the staff of Wilmer Institute and by former Residents. The Thursday morning program consisted of a paper on the present status and value of retrobulbar alcohol injections by Dr. Maumenee; a study of contusion injuries of the eye by Dr. B. L. Rones, based chiefly on material in the Army Medical Museum collected during the recent war; a paper on the ocular signs of subdural hematoma by Dr. Frank Walsh; a report by Dr. Samuel McPherson on the results of cyclodialysis operations which is in print by the American Journal of Ophthalmology. The morning program was closed by a moving-picture demonstration by Dr. J. S. Guyton on various ptosis operations. Thursday afternoon's program was a presentation by Dr. Woods of the paper by Dr. Chesney and him on an immunologic theory for the pathogenesis of interstitial keratitis, based on their experimental work of the last six years and recently published in the Journal of Experimental Medicine and the American Journal of Ophthalmology. This was followed by a symposium of three papers on irradiation therapy with the beta rays of radium and experimental work on the effect of these rays on the ocular tissues. A portion of this work will be presented at the forthcoming Academy Meeting. The session was closed with a clinical-pathologic conference presented by Drs. Hoffman and J. S. Friedenwald. The Friday program consisted of papers on muscle surgery by Drs. Angus L. McLean and John M. McLean; a very interesting paper by Dr. Townley Paton on the corneal-transplant operation and the Eye Bank in New York; a second paper by Dr. Woods on focal infection; and closed with Dr. Friedenwald's presentation of

the Gifford Memorial Lecture of the interpretation of retinal vascular lesions, recently delivered in Chicago and as yet unpublished. The afternoon program consisted of papers by Dr. Snell on scleral disease associated with rheumatoid arthritis in which he showed present in the same eye the different pathologic pictures commonly associated with scleromalacia perforans and mesial scleral dehiscence; by Dr. Maumenee, detailing his further investigations on the relationship of the virus of epidemic keratoconjunctivitis to the virus of herpes simplex; by Dr. E. L. Burky on Brucellosis; and a paper by Dr. J. S. Haas on recent developments on prostheses for ophthalmology. Then as sequel to this paper, Dr. Cutler reported the developments in this field on his service at the Dibble General Hospital, and gave a moving-picture exhibit of his recently developed technique and startling brilliant results. The session closed with a paper by Dr. Guyton on decompression of the orbit, which is in press for the forthcoming number of "Surgery," which is to be the memorial number for the late Dr. Walter Dandy, whose recent tragic death is mourned by all ophthalmologists and surgeons alike. The concluding session on Saturday morning consisted of an interesting report by Dr. Randolph, former consultant in ophthalmology in the Surgeon General's office, on the organization of ophthalmology during the past war. This was followed by a paper by Drs. Owens and Hughes on the complications of cataract extraction, which was presented at the recent meeting of the A.M.A., and by a report by Dr. Fred M. Reese on corneal changes caused by atabrine. Dr. Wm. F. Hughes then gave a report of his investigations on chemical burns of the eyes, a portion of the research on vesicant injuries by war gases in the Wilmer Institute sponsored by the Office of Scientific Research and Development

under the direction of Dr. Friedenwald. Dr. Burky gave a paper on sensitivity to lens protein and to staphylococcus toxin, on the synergistic antigenetic action of toxin in stepping up the weak antigenic action of lens protein. The program was closed with papers by Dr. Samuel A. Talbot and Dr. Fred Crescitelli on experimental work on ocular neurophysiology and a spectacular exhibit of the method of plotting a cortical map of the retina by retinal stimulation and picking up the cortical response with a cathode-ray oscillograph.

It is hoped that these meetings will hereafter continue as an annual affair, although the limits of space and the number of guests may in the future necessitate moving the actual meeting from the Wilmer Institute to a larger lecture hall in the Johns Hopkins Hospital.

OBITUARIES

JAMES WATSON WHITE

1876-1946

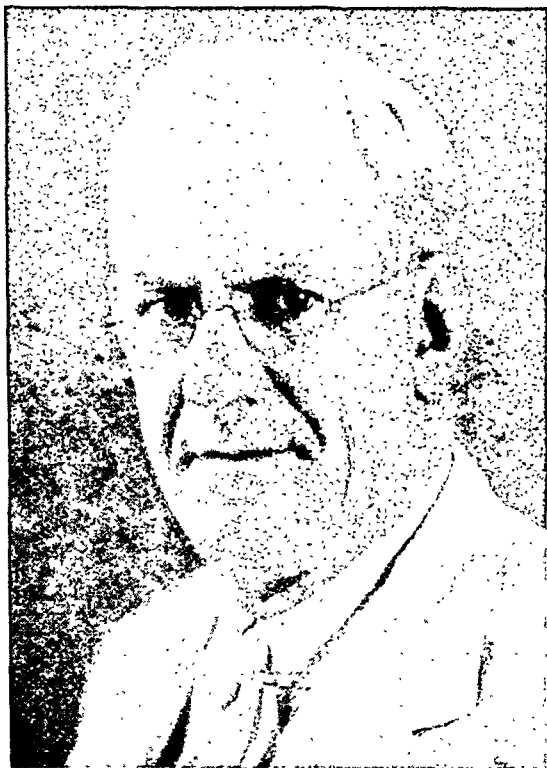
Dr. James Watson White died May 15, 1946, after a brief illness at the Mountinside Hospital, Montclair, New Jersey, in his 70th year.

He was born in New Hamburg, New York, July 3, 1876, the son of Richard Watson and Sarah Celina Myers White.

After graduating from Mount Beacon Military Academy, Beacon, New York, he taught school in his native Dutchess County for five years. In 1905 he received his M.D. degree from Albany Medical College and was in general practice from 1905 to 1913.

Dr. White became associated with Dr. Alexander Duane in 1914 and remained with him until the latter's death in 1926. The knowledge and understanding of the extraocular-muscle anomalies that this association offered were soon expressed

in Dr. White's authoritative discourses on the subject. It was with keen interest and an investigative mind that he continued with this important work and became an international authority on the subject. While Dr. White contributed many important and original observations in his lectures and writings (among



which is the "Recession of the inferior oblique"), teaching was his greatest love.

For the past 25 years he had spent much of his time in collecting and devising teaching material and in organizing and actively teaching courses on the subject of ocular-muscle anomalies in various medical societies, hospitals, and at his office. He gave freely of his time and knowledge, carrying on an extensive correspondence with his students and colleagues, as a follow-up on their work with him. He presented this difficult subject in such a vital and understandable manner, that the demand for his work was difficult to fill. It was almost solely

through his efforts that the important contributions of both Dr. Duane and Dr. White on ocular-motor anomalies became of practical use to many ophthalmologists.

He was a sincere and truly great clinician and teacher, sparing no effort to help the individual student. His now familiar "Dr. White's Diagnostic Card" was originally designed to clarify the diagnostic position of the eyes to a single member of a relatively large class. To students he was practical, patient, and considerate and showed an appreciation of their need and an ability and willingness to help. He had the insight and broad, comprehensive viewpoint of a great humanitarian.

Dr. White had been on the staff of the New York Post Graduate Medical School and Hospital since 1919, was Associate Professor of Clinical Ophthalmology at the Medical School from 1934-1938, and Professor of Clinical Ophthalmology, Executive Officer of the Medical School's Department of Ophthalmology, and Director of the hospital's service of Ophthalmology from 1939 until his death. The school is affiliated with Columbia University. Many specialists took advanced courses under him.

He was consultant at Roosevelt Hospital, New York, Brooklyn Eye and Ear Hospital, Brooklyn, New York, Mountainside Hospital, Montclair, New Jersey, Essex County Contagious Disease Hospital, Belleville, New Jersey, and the Newark Eye and Ear Hospital, Newark, New Jersey. He was attending surgeon at the Herman Knapp Memorial Hospital from 1914-1933 and former consultant at the Vanderbilt Clinic and Sloan Hospital in New York.

Dr. White was active in numerous medical societies, was always vitally interested in scientific programs, and thoroughly enjoyed the association of his colleagues. He was a member of the Ameri-

can Medical Association, New York State and County Medical Society, New York Academy of Medicine, American Ophthalmological Society, American Academy of Ophthalmology and Otolaryngology, New York Ophthalmological Society, and Orange Clinical Society, Orange, New Jersey. He was chairman of the Ophthalmological Section, Medical Society of the State of New York in 1925; chairman of the Ophthalmological Section of the New York Academy of Medicine in 1938 and 1939.

As a person, Dr. White was considerate, generous, friendly, and possessed a fascinating wit and sense of humor. He had a unique and natural approach to people that was immediately disarming and was loved by all who knew him. In the clinics or at his office, the observer never ceased to wonder at the ease with which he immediately gained the affection and coöperation of children.

His interests and hobbies were many and varied. Perhaps the most important to him was fishing, usually in the vicinity of his summer home in the Thousand Islands, on the St. Lawrence River, that he loved so much.

Not only ophthalmologists, but all who had the privilege of his friendship have suffered a great loss in the death of Dr. James Watson White.

He is survived by his widow, Mrs. Margaret McClellan White, a daughter, Miss Betty White, and a sister, Miss Mary D. White.

CASSIUS D. WESCOTT
1861-1946

Dr. Cassius D. Wescott was born in Salisbury Center, New York, May 25, 1861, and died in Chicago on May 6, 1946. He received his early education in the Chicago public schools and graduated from Rush Medical College in 1883. Becoming interested in ophthalmology a few years after graduation, he gave up general practice in 1894 to come under the preceptorship of E. L. Holmes until the latter's death.

Dr. Wescott organized the first course in practical refraction at Rush Medical College. While he had a large surgical practice, in his latter years he became interested in the study of the fundus in its relation to the general health, especially of his older patients. His interest in the study of ametropia and the phorias consumed the greater part of his time during the last 10 years of his life.

As a teacher, both of his students and the younger men who came to him as assistants, he was dynamic and, at times, dramatic. If he demanded much of those who were associated with him in the hospitals, clinic, or office it was always evident that he drove himself at a greater pace.

He was honored by being chosen president of the Chicago Ophthalmological Society, chairman of the Section of Ophthalmology of the American Medical Association, president of the American Ophthalmological Society, and president of the Institute of Medicine of Chicago.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

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| 1. General methods of diagnosis | 10. Retina and vitreous |
| 2. Therapeutics and operations | 11. Optic nerve and toxic amblyopias |
| 3. Physiologic optics, refraction, and color vision | 12. Visual tracts and centers |
| 4. Ocular movements | 13. Eyeball and orbit |
| 5. Conjunctiva | 14. Eyelids and lacrimal apparatus |
| 6. Cornea and sclera | 15. Tumors |
| 7. Uveal tract, sympathetic disease, and aqueous humor | 16. Injuries |
| 8. Glaucoma and ocular tension | 17. Systemic diseases and parasites |
| 9. Crystalline lens | 18. Hygiene, sociology, education, and history |
| | 19. Anatomy, embryology, and comparative ophthalmology |

1

GENERAL METHODS OF DIAGNOSIS

Allen, L., and O'Brien, C. S. **Gonioscopy simplified by a contact prism.** *Arch. of Ophth.*, 1945, v. 34, Nov.-Dec., pp. 413-414.

The authors describe a plastic prism for gonioscopy supported by a speculum and adjusted by a small plastic handle. The portion of the prism that touches the eye is shaped to conform to the corneal curvature. A small film of methyl cellulose solution or of a saline solution separates the cornea from the prism surface. With the instrument inserted, the patient is seated before the slitlamp, and observations are made with the biomicroscope. The slitlamp is used for illumination. Different areas are examined by having the patient move the eye or by shifting the position of the prism with the handle. More than one fourth of the circumference of the chamber angle is visible with the prism in any one position. With experience it will be found that the entire examination time will correspond roughly to that needed for other examinations

with the slitlamp. None of the eyes examined showed any injury from the procedure. The prism has been left on the normal eye for as long as 20 minutes without disturbance of the tissues and without apparent discomfort to the patient.

John C. Long.

Apin, K. **The method and clinical significance of quantitative light-sense perimetry with Maggiore's projection perimeter.** *Klin. M. f. Augenh.*, 1943, v. 109, March-April, p. 220.

Qualitative perimetry emphasizes the testing of the color sense of the retina which differs considerably in different parts of the retina. Quantitative perimetry is carried out only with colorless objects. It can be applied in two different ways: (1) the size of the test objects may be diminished step by step while the distance between the object and eye remains the same, (2) the size of the object may remain unchanged while the distance is gradually increased. With this method the retinal function is tested in a given area with an object that is just visible in that

area. Because of technical difficulties a combination of both procedures is usually used. For testing of the function of the retinal center Bjerrum's screen is very useful but not for testing of the retinal periphery. Maggiore's projection perimeter (Zeiss) meets the requirements better than a combination of common perimeters and Bjerrum's screen. The fundamental object of quantitative perimetry is to provide such differences in the size of the target at a given distance that a series of concentric isopters is obtained. In this way each retinal area is tested with the smallest visible stimulus in order to detect minimal disturbances of the retinal function. In order to get uniform test conditions examinations were carried out in a dark room illuminated only by indirect lights to provide uniformity of the contrast between object and perimeter. Shadowing of the perimeter arc has been eliminated. The projection perimeter permits rapid diminution of the object, and diminution of the contrast between object and perimeter arc. Whereas the ordinary procedure of perimetry often does not show any typical changes in such conditions as glaucoma, characteristic defects can be found by the use of the method outlined herein. For practical purposes this method of testing the retinal function can be highly recommended. Some case histories and a number of visual fields serve as illustrations of the text. (References.)

F. Nelson.

Klinger, Max. *Ophthalmologic examination in cranial trauma*. *Ophthalmologica*, 1945, v. 109, April-May, pp. 236-258.

The author emphasizes the importance of a thorough and systematic ophthalmologic examination after cra-

nial trauma, describes the different methods of investigation, and discusses the relations between the eye findings and the late pathologic consequences of the injuries. Changes of the external and internal eye muscles, variations in the retinal arterial pressure, decrease in corneal sensitivity, variations in visual acuity, fields, adaptations and color sense, often make it possible to confirm the organic origin of symptoms after brain injury and to localize a lesion in the mesencephalon, symptoms which often were considered functional and neurotic.

This essay is intended as a guide. The individual steps of the ophthalmologic study of a patient with a head injury are described in detail and their importance discussed. A plan is suggested which is based on extensive experience. Stages of the ophthalmologic examination are listed as follows:

1. History: general and ocular complaints with especial emphasis on diplopia and fatigability.
2. Examination of the anterior segment, particularly the pupillary reactions.
3. The disc, the retinal vessels, and the retinal arterial pressure.
4. Visual function, including visual acuity, accommodation, fusion, stereoscopic vision and color sense.
5. The motility, with patient standing and sitting (this is essential for testing the equilibrium) and analysis of nystagmus.
6. Extramacular visual function: perimetry and campimetry.

Alice R. Deutsch.

Osorio, L. A. *The fundus oculi in young children*. *Rev. Brasileira de Oft.*, 1946, v. 4, March, pp. 234-271.

This 35-page article is a general survey of the subject, and its many

Fox, S. A. A new type of surgical peg. *Amer. Jour. Ophth.*, 1946, v. 29, May, pp. 586-587. (1 figure.)

Geis. Disintegration of cocaine. *Klin. M. f. Augenh.*, 1943, v. 109, Jan.-Feb., p. 104.

Geis observed that cocaine-hydrochloride solutions, even if freshly prepared and not sterilized by heat, sometimes caused great irritation and even chemosis of the conjunctiva after instillation, like dionin. It is assumed that the drug had been kept too long in the pharmacy and that it had disintegrated into methyl alcohol, benzoic acid, and I-exgonin. The author suggests that cocaine might be entirely eliminated from the list of anesthetics in eye surgery. More stable substances such as pontocaine or novocaine could be substituted.

F. Nelson.

Hallett, J. W., and Pittler, S. Individually made acrylic moist-chamber spectacles and pinhole glasses. *Amer. Jour. Ophth.*, 1946, v. 29, June, pp. 725-728. (3 figures.)

Knight, H. C., and Schachat, W. S. Hyperpyrexia in treatment of ocular conditions due to syphilis. *Arch. of Ophth.*, 1946, v. 35, March, pp. 271-279.

The authors report 35 cases of syphilis of the eye in which specific anti-syphilitic chemotherapy, the usual local ophthalmic therapeutic measures, and the Kettering Hypertherm were employed.

Of 19 cases of syphilitic atrophy of the optic nerve, improvement resulted in four, or 21 percent; clinical progression of symptoms was arrested in seven, or 37 percent, and in six, or 32 percent, the disease either continued to progress or had its onset during Kettering Hypertherm treatment used in con-

junction with other (standard) methods of therapy.

In the treatment of syphilitic chorioiditis, this method of artificially induced fever therapy is valuable, particularly so when the lesions are fresh. It was employed in six patients who had acute chorioiditis; there was decided improvement in four, or 67 percent, and in the other two old quiescent lesions were present.

The method is especially valuable when employed in the treatment of the form of acute iritis that is associated with secondary syphilis and it affords a rapid form of treatment of this condition. Six cases of this type appeared in this series, and in each excellent therapeutic results were obtained.

The method is definitely beneficial in the treatment of syphilitic interstitial keratitis, and it is most helpful in alleviating the severe pain and photophobia which are often associated with this condition.

R. W. Danielson.

Leopold, I. H., and Nichols, A. Intraocular penetration of streptomycin following systemic and local administration. *Arch. of Ophth.*, 1946, v. 35, Jan., pp. 33-38.

A single intravenous or intramuscular injection of 10,000 units of streptomycin per kilogram of body weight produced detectable concentrations of streptomycin in the conjunctiva, sclera, extraocular muscles, and aqueous humor of the normal rabbit eye.

The concentrations in these tissues were increased by raising the systemic dose to 100,000 units per kilogram of body weight. With the larger systemic dose, streptomycin also appeared in the cornea, vitreous, chorioretinal tissue, and optic nerve of the normal rabbit eye.

Concentrations of streptomycin in

secondary aqueous humor were greatly increased over those in primary aqueous humor after streptomycin had been systemically administered, indicating selective action on inflamed areas.

Local administration of a solution of streptomycin containing either 5,000 or 50,000 units per cubic centimeter of isotonic solution of sodium chloride or of an ointment containing 5,000 units per gram of base failed to enter the aqueous humor of the rabbit eye with a normal cornea. However, both the solution and the ointment readily entered the aqueous humor of the rabbit eye with a partially abraded cornea.

High concentrations of streptomycin were noted in the aqueous humor of normal rabbit eyes after iontophoresis with a solution of streptomycin containing 5,000 units per cubic centimeter of an isotonic solution of sodium chloride for three minutes.

Methods of administration and doses for therapeutic purposes are suggested on the basis of these studies.

R. W. Danielson.

Mann, Ida. **A new synthetic mydriatic.** *Brit. Jour. Ophth.*, 1946, v. 30, Jan., p. 8.

In a series of 58 patients, Mann presents the results of her experience in the use of a new synthetic mydriatic, dimethylaminoethyl benzilate ethochloride. She believes that it is a valuable substitute for the atropinelike drugs. It was used in four groups of patients: (1) as a mydriatic and cycloplegic for routine study and refractions; (2) for treatment of diseases for which atropine is generally used; (3) as a substitute for atropine when that drug was generally toxic; (4) in patients known to be sensitive to atropine and hyoscine and who had allergic eczema. It was shown to be equal or superior to

homatropine and hyoscine and suitable as a substitute for atropine.

Morris Kaplan.

Moreu, Angel. **The arsenoxides in the treatment of ocular syphilis.** *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, March, pp. 157-163.

The author discusses various aspects of the superiority of the arsenoxides, as typified by mapharsen, over salvarsan and neosalvarsan in the treatment of syphilis. After injection salvarsan must be converted to arsenoxide which is the active spirillicide. Arsenoxide is ten times less toxic in curative doses than are salvarsan and neosalvarsan. Nitritoid crises and liver damage do not occur with arsenoxide. The possibility of kidney damage, however, remains. Dosage and method of administration in 26 patients with ocular syphilis is given.

J. Wesley McKinney.

Murphey, P. J., and Schlossberg, L. **Eye replacement by acrylic maxillofacial prosthesis.** *The Military Surgeon*, 1945, v. 96, June, p. 469.

The various steps in the preparation of a prosthesis of acrylic material are described. Such prostheses have the following advantages: the natural contours of the face are restored; better matching of color is possible; stimulation of orbital tissues occurs by contact with the prosthesis; the acrylic material is only slightly susceptible to etching and can be repolished easily; the prosthesis is resistant to breakage. A number of pictures of the process of manufacture are included.

Robert N. Shaffer.

Riddell, W. J. B. **Clinical trial of a synthetic mydriatic.** *Brit. Jour. Ophth.*, 1946, v. 30, Jan., p. 1.

Dimethylaminoethyl benzilate etho-

chloride is a promising synthetic mydriatic. In tests in which it was compared with atropine and with homatropine and cocaine for its mydriatic and cycloplegic action it proved to be an efficient substitute for homatropine but was neither so rapid nor so prolonged in action as atropine. There were no signs of sensitivity to it in those patients known to be sensitive to atropine. Two drops of a 1-percent solution were used. Morris Kaplan.

Roth, R. J. Detergents or wetting agents. *Amer. Jour. Ophth.*, 1946, v. 29, June, pp. 717-720. (2 figures, references.)

Ruedemann, A. D., and Glasser, Otto. Beta radiation in ophthalmology. *Cleveland Clinic Quart.*, 1946, v. 13, April, p. 104.

Beta radiation has been used by the authors in the treatment of corneal scars, recurrent pterygia, symblepharon and in a variety of lid conditions, including vernal catarrh, lid allergies, and papillomata. Stubborn chronic conjunctivitis and severe keratoconjunctivitis have responded well to this form of irradiation therapy.

A glass tube with radon in a small metal container provides the source of the beta emanations. This cylinder is applied to the cornea or lid, after topical anesthesia, at the end of a 35 cm. handle. There is only a 3-percent emission of the more deeply penetrating gamma rays. The lack of penetrability of the beta rays is demonstrated by the fact that superficial corneal scars responded better than more deeply situated opacities. In each instance, the reaction time was 14 to 21 days. The average number of treatments, for corneal scars, was seven. Benjamin Milder.

Rycroft, B. W. Sub-conjunctival penicillin and intraocular infection. *Brit. Jour. Ophth.*, 1945, v. 29, Oct., pp. 501-511.

A survey of experimental evidence regarding the route of administration of penicillin is given, and the following conclusions are summarized.

Direct intravenous injections of penicillin are the most effective means of obtaining high concentrations and bacteriostasis in the vitreous. A single injection of purified penicillin does little harm and will control incipient infection by susceptible organisms if given within 12 hours, and will maintain bacteriostasis for at least 24 hours. Multiple injections cause serious intraocular damage. Local applications of drops or ointment will not pass penicillin into the aqueous in normal eyes but do so where the cornea is inflamed or traumatized. Iontophoresis, constant corneal baths, and subconjunctival injections will maintain bacteriostatic levels in the aqueous, especially in the presence of inflammation. Intramuscular and intravitreous injections of penicillin do not produce bacteriostatic concentrations in the aqueous or vitreous and will not control experimental inflammation caused by organisms susceptible to penicillin.

Ten cases are reported in which subconjunctival injections of sodium penicillin in normal saline were made in hopelessly blind eyes which were to be removed. To prove that penicillin can reach the interior of the human eye in bacteriostatic amounts after subconjunctival injections, aspiration of the media was carried out after certain intervals of time, and the amount of penicillin present in the aqueous and vitreous was assayed. It was found that penicillin penetrated to the aqueous humor in seven of eight eyes after an

interval of 15 minutes. Assay of the vitreous was carried out in six eyes of which three showed bacteriostasis after 45 minutes. All amounts of penicillin detected in the aqueous or vitreous after subconjunctival injections were above bacteriostatic level.

Subconjunctival injections of 4,000 Oxford units of sodium penicillin will produce bacteriostasis of susceptible organisms in the aqueous humor of the human eye within half an hour of injection. It is probable that this occurs later in the vitreous humor and is likely to remain for at least 24 hours. Subconjunctival injection is a practical method of causing penicillin to reach the interior of the eye, and the earlier the injections are made, the better the results. Large doses should be employed not only because of the slow rate of diffusion but also to avoid the risk of producing penicillin resistance. (Bibliography.) Edna M. Reynolds.

Sorsby, Arnold. *Penicillin in ophthalmology*. Brit. Jour. Ophth., 1945, v. 29, Oct., pp. 511-536.

A complete review of the literature on the tolerance of the various ocular tissues for penicillin and the concentration of penicillin in the ocular tissues after various methods of administration is given. The literature regarding the use of penicillin in experimental infections and in clinical infections is also reviewed.

The marked difference in the sensitivity of different organisms to penicillin makes it seem that dosage is determined as much by the causal organism as by the patient's tolerance.

It has been established that high concentrations of the penicillin in current clinical use are not without deleterious effects on the cornea. Drops in a concentration of 2,500 units per

cubic centimeter are generally well tolerated. Subconjunctival injections of 500 to 600 units in 0.5 c.c. of water are well tolerated and can be repeated daily without much discomfort. Injections of 200 units of penicillin in 0.25 c.c. of isotonic saline solution into the anterior chamber is as much as it is justifiable to give. Injections into the vitreous are badly borne in dosages over 100 units.

There is lack of evidence that penicillin injected intramuscularly reaches the interior of the eye, but local use of penicillin by corneal bath, ionization, and subconjunctival injection give high concentrations of penicillin in the anterior segment of the eye. Experimental evidence does not indicate that these methods give any adequate concentration in the interior of the eye.

In the presence of corneal abrasion or ulcer, penicillin penetrates readily through the cornea into the anterior chamber. Intravitreal injection of penicillin in a grossly infected vitreous is justifiable, although experiments on the normal eye indicate that intravitreal injection must be practiced with extreme caution.

All the common causal organisms of ophthalmia neonatorum respond to the administration of penicillin in concentrations of 2,500 units per cubic centimeter. In blepharitis, paints containing 1,000 units per cubic centimeter are adequate.

Penicillin may soon replace the sulfonamides in treatment of the external infections of the eye. Systemic injection of the drug is not indicated, since it does not pass the blood-aqueous barrier and does not affect acute intraocular infections.

Clinical experience with penicillin in the treatment of trachoma is as yet too limited to permit any statement as to its value. It is generally assumed that

penicillin is ineffective against virus infections.

The use of penicillin in syphilitic infections of the eye would appear to be theoretically possible. (Bibliography.)

Edna M. Reynolds.

Scheie, H. G., and Hodes, P. J. **Injection of oxygen into Tenon's capsule.** Arch. of Ophth., 1946, v. 35, Jan., pp. 13-14. (See Section 16, Injuries.)

Thiel, R. **Testing and preservation of cutting qualities of surgical instruments.** Klin. M. f. Augenh., 1943, v. 109, Jan.-Feb., p. 89.

The customary methods of testing surgical instruments by cutting a hair or a membrane tightly stretched over a drum, are not satisfactory because such procedures are apt to damage the cutting edge. Thiel examines such instruments under a microscope instead. The sharpness of the point and the uniform configuration of the cutting edge as seen with strong magnifications give better evidence of the usefulness of the instrument, although it does not reveal much about the quality of the material. For the preservation of the sharpness of the cutting edge the methods of sterilization are of utmost importance. Sterilization in 95-percent alcohol followed by five seconds in live steam yielded the most disastrous results, whereas sterilization in hot air for 40 minutes never damaged the instrument noticeably. In order to avoid mechanical and chemical damage of the blade after use, it is kept in a specially constructed U-shaped metal holder. Damage of the blade through touch is practically impossible. Each instrument is kept and sterilized in its individual holder. After use the blade is never touched but is rinsed with normal saline solution and alcohol or ether to remove all traces of water. Then the

instrument is immersed in a solution of bone oil in ether, leaving a fine oily film on its surface which protects it absolutely from the influence of humid air. To remove this film it is sufficient to dip the instrument in ether for a moment before it is used for another operation.

F. Nelson.

3

PHYSIOLOGIC OPTICS, REFRACTION, AND COLOR VISION

Bietti, G. B., and Scano, A. **A study of the retinal circulation in the "black-out" of aviators.** Soc. Oft. Ital., 1943, v. 3, pp. 1-23.

The authors studied the retinal circulation experimentally with the Zeiss endoscope while in flight and confirm the opinion that "black-out" is the result of a disturbance of the relationship between intraocular pressure, pressure in the retinal arterioles and capillaries, and endocranial pressure. Normally, arterial pressure is higher than retinal pressure, which, in turn, is greater than endocranial pressure. In flying head-first, retinal pressure becomes higher than arterial or endocranial. In collapse, the arterial pressure falls below the endocranial, and in the latter two conditions vision may be lost, owing to failure of retinal circulation.

Similar symptoms were produced on the ground by means of varying pressure upon the globe. (7 illustrations.)

Eugene M. Blake.

Cowan, A. **Ocular imagery.** Arch. of Ophth., 1946, v. 35, Jan., pp. 42-44.

After a discussion of the advantages and disadvantages of the theory of collinear imagery, the author states that the aberrations of any optical system increase with the diameter of the aperture. With a small pupil there are less aberration and greater focal depth,

but less brightness; and if very small, even with adequate illumination, the beneficial effect of the narrow aperture is overcome by the diffraction at the edges. The pupil must be large enough to afford sufficient brightness and at the same time allow the formation of a sharp image.

Theoretically, the pupil must be neither too wide nor too narrow. The resolving power is fairly constant as long as the diameter is between 3 mm. and 5 mm., but particularly because of the peculiar nature of the eye as an optical instrument, a large pupil has little or no effect on the distinctness of the useful retinal image as long as the system is properly in focus, whether normally, by the accommodation, or by the aid of a lens. A small pupil serves its best purpose when the image is not sharply focused.

In ocular refraction the importance of the action of the pupil must not be overlooked. Only by the use of a cycloplegic can both the accommodation and the activity of the pupil be kept under control.

Since only a relatively small bundle of rays, close to the visual axis, forms the useful retinal image, it is often stated, and correctly, that with a large pupil the aberration a short distance from the axis sometimes seriously interferes with the results of retinoscopy. In most cases this fault can be eliminated by having the patient fixate the center of the mirror so that the examiner, disregarding the peripheral reflexes, can measure the error along the visual axis.

The closest approximation to the exact correction of ametropia should be the aim of the ophthalmologist; but his knowledge of physiologic optics will enable him not only to secure the best results but to know when further exact-

ness is superfluous. Perfection is neither possible nor necessary in an instrument so adaptable as the eye.

R. W. Danielson.

Csapody-Mocsy, Martha. *Test charts for women's needlework*. Klin. M. f. Augenh., 1943, v. 109, March-April, p. 251.

Needlework and reading are different tasks. The common test charts for close work did not contain any patterns of structures of woven or embroidered fabrics which would enable a person engaged in manufacturing or using such material to judge the amount of visual acuity necessary to reorganize and analyze the elements of the pattern or to find flaws in the weaving. The author undertook the task of designing test charts for women's eyes engaged in different textile work ranging from simple patterns made with rather rough material to the finest and most complicated designs for which very delicate threads are used. The patterns are printed in rows similar to reading charts. By the use of these charts the examiner is enabled to test workers, even illiterates, for their near vision, to determine which corrective lenses are required by the individual, and determine which person's eyes are particularly adapted for a certain type of textile work. (1 test chart.)

F. Nelson.

Easton, D. M. *Acetylcholine in the light and dark adapted frog retina*. Proc. Soc. Exper. Biol. and Med., 1945, v. 59, p. 31.

Extraction of frog retinas in acidified Ringer solution reveals an average acetylcholine content of 3.4 gamma/gm. in light-adapted and 3.6 gamma/gm. in dark-adapted frogs. Direct comparison of acetylcholine activity in extracts of

light- and dark-adapted retinas, without reference to absolute magnitudes, also reveals no difference greater than the error of the method. The lack of significant difference is in accord with the work of Therman, but not with that of Lange, who finds a tenfold increase upon dark adaptation. The range of experimental error of the assay method is no less than 10 percent, even under the best conditions, and a difference of such magnitude might very well be of physiologic significance.

Robert N. Shaffer.

Eggers, H. Refraction by the astigmatic eye. *Arch. of Ophth.*, 1946, v. 35, April, pp. 346-353.

The contours of an astigmatic beam of light are described. A formula is given for the determination of the circle of least confusion in the interval of Sturm. In a practical refraction, one attempts to eliminate the interval of Sturm by making the two focal points of the principal meridians coincide. In cases in which a full correction of the astigmatism cannot be tolerated, one should first reduce the interval of Sturm, and with it the size of the circle of least confusion, by a partial correction of the cylindric error. Then the position of the reduced astigmatic interval is shifted by means of spherical correction so as to bring the circle of least confusion on the retina. The amount of spherical power required is half the dioptric value of the remaining uncorrected astigmatism. A similar procedure was recommended by Copeland who stated that "if the cylinder is reduced a change must be made in the spherical element of the lens. In reducing the cylindric element of any correction add half of the amount of the reduction to the sphere."

John C. Long.

Elliott, A. J. Significance of aniseikonia in aviation. *Arch. of Ophth.*, 1946, v. 35, April, pp. 354-360.

The relationship of aniseikonia to flying performance in the landing of aircraft was investigated in two selected groups of the Royal Canadian Air Force. In the first group there were 175 trainees who had ceased training because of difficulties in landing and in the second group there were 50 experienced pilots. The amounts of aniseikonia were found to be very small in each group, and no practical correlation with landing performance could be ascertained.

A series of landings was made in order to study the practical effect of various aniseikonic lenses on flying performance during landing. It was noted that when monocular visual clues predominated the flying performance was not affected by the anomalous binocular clues produced by wearing aniseikonic lenses.

John C. Long.

Fishenden, R. B. Types, paper, and printing in relation to eyestrain. *Brit. Jour. Ophth.*, 1946, v. 30, Jan., p. 20. (See Section 18, Hygiene, sociology, and history.)

Fletcher, R. J. Presbyopic additions. *The Optician*, 1946, v. 61, April 26, pp. 245-246.

Amplitude of accommodation falls fairly rapidly between the ages of 45 and 50 years. Textbook table additions are often too high for the patient's comfort. A patient should have one half to one third of his reserve accommodation uncorrected. A table is presented that reveals the amplitude of accommodation and the addition necessary for varying distances, for example, desk work, based on measurements in 300 patients.

I. E. Gaynon.

Gescher, J. A new arrangement for the objective measurement of dark adaptation. *Klin. M. f. Augenh.*, 1943, v. 109, Jan.-Feb., p. 99.

Following Rieken's advice to use optokinetic nystagmus as an objective test for dark adaptation the author developed an arrangement of apparatus which allows exact registration of the process of dark adaptation and subsequent transposition of the data into the Engelking-Hartung adaptation curve. On a Cord nystagmus drum, placed 30 cm. in front of the patient's eyes, a light circle, 10 cm. in diameter, is projected with a Hess hammer lamp that is adjusted at the patient's right side and a little behind him. By means of two rheostats, the light intensity reflected from the illuminated spot on the drum can be regulated and registered exactly. The beginning and disappearance of optokinetic nystagmus can be observed easily and accurately with the help of the Zeiss corneal microscope which is equipped with a lamp which projects a spot of blue light three millimeters in diameter, onto the sclera. The whole apparatus is first tested and adjusted by examining a person with a normal adaptation curve. Uncertain subjective factors are eliminated. The objective test is more accurate and less time consuming than any subjective examination. (References.) F. Nelson.

Göthlin, Gustaf F. The fundamental color sensations in man's color sense. *Kungl. Svenska Vetenskapsakademiens Handlingar*, 1943, 3rd series, v. 20, no. 7.

The author presents an extensive treatise in which he describes his method of using the liminosspectroscope for measuring the monochromatic radiations within a spectral region. His work on the monochromatic radiations of

wave length 460, 455, 450, 445, 440, 435, and 430 mμ in the indigo region of the spectrum leads him to believe that blue is a fundamental color and that violet and indigo arise from the fusion of blue and red receptors. The zone of pure yellow never exceeded two mμ in the spectrum and its position varied much in the subjects tested. The fact that the color discrimination of maximum yellow revealed a minimum in pure red and pure green, leads the author to believe that a person with normal color vision need have no special receptors for yellow. Hence, the fundamental hues of the human color sense are red, green, and blue. A review of the present status of color receptors is given. The sensation of white is a synthesis in two stages: stimulation of red and green produces yellow, and yellow and blue produce white. (21 figures, references.) I. E. Gaynon.

Grieve, John. Incidence of defective colour vision. *Nature*, 1946, v. 157, March 23, p. 376.

The usually reported incidence of defective color vision in males is seven to eight percent. This paper reports an incidence of 6.63 percent, in a survey of 16,000 Royal Air Force candidates. Ishihara charts were used in daylight, and if the individual failed to pass this test, the Giles-Archer Colour Perception Unit (not described) was used. The individual was considered to be normal if the latter test was performed without error. The results are in harmony with previous reports.

Benjamin Milder.

Halstead, W. C. Chronic intermittent anoxia and impairment of peripheral vision. *Science*, 1945, v. 101, June 15, p. 615.

Twenty male subjects selected to

meet the standards of the Service Air Corps were exposed in a low-pressure chamber to a simulated altitude of 10,000 ft. above sea level for five or six hours per day, six days a week, for four or five weeks. During the third and fourth week, 13 of the 20 subjects developed a marked and progressive impairment of peripheral vision. The subjects were not aware of this loss. It could not be immediately relieved by inhaling pure oxygen. In some cases days or weeks elapsed before a return to normal visual efficiency occurred. In some of the cases central vision also was temporarily impaired.

Four other subjects were similarly exposed to altitudes ranging from 11,500 to 18,000 ft. In them the impairment of peripheral vision appeared earlier, was more marked, and normal vision was recovered more slowly. The cortex of the frontal lobes of the brain is the probable region whose involvement produces this peripheral loss in visual function. Robert N. Shaffer.

Hamburger, F. A. **Monocular dominance in binocular vision.** *Klin. M. f. Augenh.*, 1943, v. 109, Jan.-Feb., p. 1.

Even in eyes with identical visual acuity and equal refraction, one eye is often dominant over the other. Sometimes even an eye with lesser visual acuity is dominant. However, dominance of one eye is not always constant. For perfect binocular vision it is desirable not only to have both eyes equal in their monocular performance but also that a minimum of dominance of one eye over the other is either present in the beginning or acquired by practice. As consultant Navy ophthalmologist in charge of a range-finder training school, the author examined two selected groups of participants of separate classes. All the men had per-

fect vision in both eyes, and faultless binocular vision and depth perception. For determination of dominance, Hamburger used a simple pencil-light test, once before the training course started and once upon graduation. About one third of the men tested showed dominance of the right eye in the beginning, but it was found in only 15 percent at the end of the training period. Less than one percent had a dominant left eye in the first test, less than 0.5 percent in the second test. The author attributes the disappearance of dominance to the training of binocular vision in range finding. It is his opinion that dominance of one eye is the equivalent of neglect or a latent tendency to amblyopia of the other. Apparently there is no connection between dominance and "handedness." Not a single man was left handed. The relative inferiority of one eye, usually the left, may be influenced to a certain extent by habitually neglecting it in bodily postures and movements such as, for instance, the use of the right eye more than the left in the aiming of a gun.

F. Nelson.

Handman, M. Sr. **Familial paresis of accommodation.** *Klin. M. f. Augenh.*, 1943, v. 109, March-April, p. 186.

The patient had had difficulty in reading since she was a small child and used her mother's reading glasses. She also was night blind. Her mother had glaucoma simplex and coronary cataract. The patient was seen when she was 18 years of age and had a manifest hypermetropia of 0.5D. Twelve years later her accommodation was almost zero. She also had coronary cataract. She had no children. One of the patient's sisters had five children of whom one daughter had an accommodation of only 5.0D. when 23 years of age,

another daughter only 1.0D., and one son 2.0D. in each eye. The other children had no pronounced abnormality of accommodation. Disturbances of the pupillary reactions were not observed. The lesion was probably hereditary and caused by an early degeneration of the nucleus for accommodation below the aqueduct of Sylvius. F. Nelson.

Hardy, L. H., Rand, G., and Rittler, M. C. Tests for the detection and analysis of color blindness. *Arch. of Ophth.*, 1946, v. 35, March, pp. 251-270.

The authors conclude that the Rabkin test, when used with care in administration, scoring, and interpretation, yields much more information concerning the type of defect of the examinee than does, for example, the Ishihara test or the American Optical Company test. As the result of their study of the test, the authors recommend changes in scoring certain of the plates; a revised procedure for classifying the type of defect in red-green vision is described, and constructive comments are offered for the improvement of some of the plates. In addition, the following general conclusions concerning the second edition of the Rabkin test seem justified.

When properly administered, the test affords a good device for screening the subject with defective color vision from the subject with normal color vision if 75 is taken as the critical performance score.

No analysis as to type or extent of defect can be based on the score alone.

The test taken as a whole affords an excellent means of classifying red-green dichromasy into the two groups (protanopia and deuteranopia), and of classifying red-green anomalous trichromasy into the two groups (deuteranomaly and protanomaly).

The test as now constructed is, however, not adequate to differentiate anomalous trichromasy and dichromasy. R. W. Danielson.

Heinsius, E., and Hamburger, F. A. The comparability of measurements of dark adaptation and twilight vision. *Klin. M. f. Augenh.*, 1943, v. 109, March-April, p. 204.

In modern warfare it is no longer enough to eliminate men with hemeralopia from combat teams. It is necessary to select from a large number of soldiers those who have the best night vision. Optimal requirements are (1) shortest possible adaptation time, (2) low threshold after completed adaptation, (3) high visual acuity in minimal illumination, (4) relative insensibility to dazzling. It is not certain that these four qualities can be found together in one particular eye. Three instruments for measurement have been available: the Engelking-Hartung adaptometer, Comberg's nyctometer, and the Nowak-Wetthauer apparatus. Because electric current upon which the instruments depend is variable, absolute values cannot be obtained. It is also difficult to manufacture the necessary light filters uniformly, so that their light-absorptive qualities are identical. Consequently measurements are not absolutely comparable, even with the same apparatus, much less with different ones. The Nowak-Wetthauer apparatus is best suited for these examinations and will be perfect after it has been equipped with a current regulator. (1 figure, 6 charts, references.) F. Nelson.

Herzau, W. Horror fusionis and aniseikonia after trauma. *Klin. M. f. Augenh.*, 1943, v. 109, March-April, p. 193.

An army officer, 40 years of age,

had been wounded by a shell splinter in the face and right antrum that resulted in concussion of the right eye with concentric choroidal rupture and pupillary paresis. Vision in that eye was reduced to 5/10; the other eye was normal. Double vision was noticed after the trauma. The images were uncomfortably close together. There was a manifest divergence of two degrees in the primary position that increased in looking up and to the side. It was absent when looking down. It was assumed that the exophoria was present before the injury. The images of the injured right eye appeared considerably smaller and blurred. Horopter apparatus and metroscope could not be used to determine aniseikonia. Size lenses were not available. As substitutes twin lenses were used with the help of which the diplopia disappeared when the patient looked straight forward into distance. With pinhole the same effect was obtained immediately. A special lens was ground to compensate for the 13-percent size-difference of the images. With this correction parallel position of the eyes and binocular single vision resulted only when patient looked straight forward. For the right eye a diaphragm with two holes was given, a central 4-mm. hole for distance and another below and nasally for reading. This correction relieved the disturbance.

F. Nelson.

Hirsch, M. H. **Relation of visual acuity to myopia.** *Arch. of Ophth.*, 1945, v. 34, Nov.-Dec., pp 418-422

Visual acuity and the degree of myopia were determined in 64 eyes. The myopia ranged from 0.50 to 13.50 D. The visual acuity decreased in an orderly fashion as the degree of myopia increased. Plotting the logarithm of visual acuity on the logarithm of the

degree of myopia gives a coefficient of correlation of +0.95. Confidence limits were determined for the regression lines and tables set up for predicting either the degree of myopia or the visual acuity when the other is known. The data presented would be of value in refraction in guarding against an overcorrection of the myopia and also in the detection of malingering.

John C. Long.

Junker, H. **Monjé's test for stereopsis.** *Klin. M. f. Augenh.*, 1943, v. 109, March-April, p. 239.

Monjé's new apparatus, devised to measure depth perception, was used for the screening of Navy personnel in a range-finder school for naval artilleryists. The task was to eliminate the influence of the displacement of the physiologic middle or zero position of the central one of three threads in contrast to its physical zero position. This phenomenon had been observed by Monjé in 58 percent of all persons tested by him. With the Monjé apparatus which exploits this observation it is now possible to select the persons who possess a perfect depth perception and are fit for training in range finding. (References.)

F. Nelson.

Martin, D. H. H. **Some refinements in cross-cylinder technique.** *The Optician*, 1946, v. 111, May 17, pp. 307-310.

When using the cross-cylinder, the sphere in the trial frame should be adjusted with each change of the power of the cylinder but not of its axis. During the test hypermetropia is undercorrected and myopia overcorrected less than 0.50 D. The size of the test letters used should be small enough to be legible to the patient on either side and yet with the cross-cylinder in either position to show a change on reversal of the

cross-cylinder. When vision is 6/4 or better a 0.12D cross-cylinder should be used, between 6/5 and 6/10 a .25D cross-cylinder, and when it is less than 6/12, a 0.50D cross-cylinder. The position of the axis of a cylinder should be determined before ascertaining its power, and then the power should be checked until there is equality in either position.

I. E. Gaynon.

McFarland, R. A., Halperin, M. H., and Niven, J. I. **Visual threshold as an index of physiological imbalance during insulin hypoglycemia.** *Amer. Jour. Physiol.*, 1946, v. 145, Jan., pp. 299-313.

In order to measure the effects of disturbances in oxidative metabolism, the writers investigated the changes in the thresholds of the foveal differential discrimination of light intensity caused by insulin hypoglycemia in four human subjects. The insulin was administered intravenously. A rise in the visual thresholds is produced if the capillary blood sugar drops below 65-70 mgm. percent. The inhalation of 100-percent oxygen results in a reversal of a large part of the impairment caused by hypoglycemia. The effect of hypoglycemia on vision is probably due to an impairment of the oxidative processes in the nervous tissues.

Melchior Lombardo.

McKay-Ferguson, Orlig. **Notes on letter acuity.** *The Optician*, 1946, v. 61, April 26, pp. 248-252.

The determination of letter acuity is perhaps the most simple and yet most significant item in any preliminary subjective examination. The letter "B" is the hardest to recognize. The following letters are recognized, the first most easily and the following with increasing difficulty: L, T, V, C, O, Y, P, F, D, Z, N, E, R, S, G, and B. Other sig-

nificant factors in visual acuity are the resolving power of the eye, aligning power, amount of accurate fixation, pupil size, and degree of contrast.

I. E. Gaynon.

McKay-Ferguson, Orlig. **The coating of optical surfaces.** *The Optician*, 1946, v. 61, March 1, pp. 83-84, 103-104.

The new technique to minimize surface reflection and increase light transmission is discussed. The amount of Fresnel reflection may be calculated if the angle of incidence of the beam and the refractive indices of the two media are known. A considerable amount of light is reflected and lost in ophthalmic instruments. If both sides of the lens are coated, the reflected rays will become neutralized by reflective interference. The energy is not destroyed and augments the amount of light transmitted by refraction. Methods for producing the coating are described.

I. E. Gaynon.

Morgan, G. E. **Amblyopia ex anopsia in the Armed Forces.** *Amer. Jour. Ophth.*, 1946, v. 29, June, pp. 713-717. (See Section 4, Ocular movements.)

Pascal, J. I. **Astigmatism and the accommodative unit.** *The Optician*, v. 111, May 10, p. 285.

The astigmatic correction at near is always a little different from the astigmatic correction found at distance. An accommodative unit is the amount of accommodation necessary at one meter. In the ametropic eye the diopter, used as a unit, is either too large or too small. Using the formula $U = 1 + \frac{2}{dL}$, in which U is the accommodative unit, L is the correcting lens, and d is the distance in meters between the correcting lens and the principal plane of the eye, a different refractive status

of the principal meridians may be calculated. As the two principal meridians have different accommodative units, the difference between these two creates the difference in astigmatism at near.

I. E. Gaynon.

Podestà, Hans. **The systematic scientific structure of the color body.** Klin. M. f. Augenh., 1941, Supplement.

In this monograph the author reviews the development of the science of the color sense. The theories concerning the origin of colors, the function of normal and abnormal color perception including a study of the ontogenesis and phylogenesis of the color sense are discussed. The purpose of this little book (60 pages) is to familiarize the ophthalmologist with the simplest fundamentals of the conception and laws of this branch of science and to give a continuous presentation of the elementary facts of the psychologic foundations. The structure of the total color continuum in which the various relations between the color sensations are arranged according to subjective (psychologic) absorption of objective (external) color stimuli is illustrated symbolically in schematic stereometric pattern. Its geometric construction is only alluded to briefly. (14 figures, references.)

F. Nelson.

Rieken, H. **Objective examination for nyctalopia with makeshift apparatus.** Klin. M. f. Augenh., 1943, v. 109, March-April, p. 197.

In previous papers Rieken demonstrated the usefulness of optokinetic nystagmus for testing dark adaptation. For tests under primitive conditions the author recommends the following procedures. Strips of commercially manufactured luminescent paper are cut in various widths and

pasted vertically on a dark band made of fabric or paper, leaving dark spaces between the luminescent strips. The band is either put around a drum or cylinder which can be rotated about a vertical axis by means of a simple mechanism over two parallel cylinders that rotate synchronously. The latter provides a larger optokinetic stimulating surface. The optokinetic nystagmus that is induced in a dark room can be observed by means of a simple electric ophthalmoscope, the light bulb of which is dimmed with a blue glass filter. Illumination of the pupil should be avoided in order to eliminate the disturbing interference of the light cone of the ophthalmoscope. The apparatus is well suited for orientation tests and to eliminate malingering. (2 figures, references.)

F. Nelson.

Silva, Daniel. **Optic theory of contact lenses.** Bol. del Hosp. Oft. de Nuestra Señora de la Luz, 1946, v. 3, Jan.-April, pp. 131-142.

With illustrations and graphs, the author discusses optical principles of contact lenses, and leads up to the following conclusions: Forming a continuous optical system with the eye itself, the contact lens avoids the disturbances produced by the distance factor between constituent parts of the ordinary spectacle system, prevents secondary images and distortions, and avoids anisometropia. W. H. Crisp.

Stevens, D. M., **Relation between dark adaptation and age.** Nature, 1946, v. 157, March 23, p. 377.

Night vision is worse in the aged, because the changes of senility produce a yellowing of the ocular media. In measuring the dark-adapted visual threshold with the Wald-Stevens Adaptometer, in nutritional surveys, it was

found that there was a progressive rise in the threshold with increasing age. It is concluded, therefore, that dark-adaptation tests based on a normal range of dark adaptation in healthy persons are less sensitive for detecting pathologic states in older individuals, and a correction factor should be applied in evaluating such tests in persons over the age of 30 years.

Benjamin Milder.

Wald, George, *Human vision and the spectrum*. Science, 1945, v. 101, June 29, p. 653.

The author discusses the physiology of light perception by the retina. His investigations confirm previous measurements on the spectral sensitivity of foveal cones and of rods well outside the macula. In addition, he has measured the sensitivities of peripheral cones by calculating the differential between the data found in a light- and dark-adapted eye. The differences in sensitivity of central and peripheral cones, and of normal and aphakic eyes yield estimates of the absorption of light by the macular pigment and by the lens. The pigment of the human macula has also been extracted and certain of its optical and chemical properties have been examined directly. The analytical data are too detailed and technical to summarize satisfactorily.

Of clinical interest is the amazing increase in sensitivity in the violet and ultraviolet portion of the spectrum in the aphakic eye due to the loss of the filtering process of the yellow lens. In illumination in the region of 365 μ , the average increase in sensitivity amounts to 1,000 times that of the normal eye. The author has seen patients with aphakic eyes read a Snellen chart that he was unable to see in this illumination.

Robert N. Shaffer.

Yasuna, E. R. *Hysterical amblyopia, its differentiation from malingering*. Amer. Jour. Ophth., 1946, v. 29, May, pp. 570-578. (3 figures, 1 table, references.)

4

OCULAR MOVEMENTS

Apin, K. *Constructive procedures to combat strabismus in Latvia and the result of this campaign*. Klin. M. f. Augenh., 1943, v. 109, Jan.-Feb., p. 63.

Worth stated that in 93.1 percent of all patients strabismus starts before the sixth year of life but only 6.1 percent of them appear for treatment at or before that time. There are various reasons for this deplorable but undeniable delay. Among them are: Insufficient enlightenment of the laymen and the ignorance of many general practitioners and ophthalmologists of the importance of early conservative treatment of the very young child in whom the amblyopia can be prevented and good binocular vision can be established. Apin started an intensive campaign in Latvia directed against lack of proper knowledge and interest among physicians. Pamphlets and posters were distributed and exhibited, and articles published in the daily press and in magazines. The work was gradually expanded and intensified over a period of many years. Systematic examination of school children, and later also of children of preschool age, in kindergarten and nursery, was introduced. The success of this campaign soon became noticeable though much that was desirable remained to be done. Reported statistical data relating to 1,981 cases of strabismus of all age groups seen between 1922 and 1940 are analyzed. Though the number of children between the first and fifth year of life

was still relatively small at the time of this publication (10.6 percent) it was at least considerably higher than at the beginning of the campaign (1.3 percent). Lack of understanding and perseverance in conservative functional treatment still represented the most important handicap. Most patients or their parents were predominantly interested in the elimination of the cosmetic aspect of strabismus, not in functional prophylaxis and rehabilitation. Many patients never returned after the first consultation. Among the comparatively small number of patients who were willing to carry on with the methodical conservative therapy, a rather high percentage showed improvement of amblyopia. Unfortunately, only 10 of the 1,981 patients were below the age of six years when first seen. The vast majority came so late that only moderate improvement could be expected. The program as a whole shows the importance of enlightenment and education as the predominant factors in the important struggle directed toward saving the function of the eyes of the four percent of the total population who have strabismus.

F. Nelson.

Bietti, G. B., and Scano, A. The effect of anoxia upon ocular movements. *Trans. Soc. Oft. Ital.*, Rome, 1943, v. 3, pp. 1-11.

In an atmosphere corresponding to an altitude of 5,800 to 8,000 meters there was slowing of ocular movements and increased difficulty in reading, which reached a point 218 percent of normal. Fixation required a longer time, and the number of fixation periods in reading increased. Attention and comprehension were greatly retarded. The picture is very much like that observed in the study of ocular fatigue.

Eugene M. Blake.

Bucker, C. W. Seesaw nystagmus associated with choroiditis and positive neutralization test for toxoplasma. *Arch. of Ophth.*, 146, p. 35, March, pp. 301-302.

Nystagmus in which one eye turns rhythmically up and down while its fellow moves contrarily, in the nature of a seesaw, is strange and rare. The only case that Rucker has been able to find in the literature is one reported in 1914 by Maddox.

This case occurred in a white man, aged 51 years, who had come to the Mayo Clinic on October 11, 1944, complaining of loss of vision. He had been myopic since childhood and had worn glasses for thirty years.

His present difficulty began four years before admission, when he noted failure in his vision. Two years later further deterioration had occurred in the visual acuity, and about that time he had blisters on his lips for several months. One year before his admission his eyes began to jump. For six months before admission he had had a humming tinnitus.

On examination at the clinic the visual acuity was recorded as 2/60 in the right eye and 3/60 in the left eye. There was a constant seesaw nystagmus. As the right eye turned up, the left turned down; and as the right turned down, the left turned up. The rate was 128 beats per minute, and the movement covered a distance of approximately one millimeter.

Examination disclosed the following: there was myopia of 4D., the entire choroid of both eyes appeared to be sclerotic and finely mottled with pigment, the retinal arterioles were greatly attenuated, and the fields of vision were restricted to small islands.

All laboratory examinations were negative except that a specimen of the

patient's blood produced a slight to moderate neutralization against the organism *Toxoplasma*.

To account for disturbed pupillary reflexes and disjunctive nystagmus a lesion in the brain would be expected to involve the midbrain and pons. Attempting to name the implicated fiber bundles at present leads into the field of speculation. R. W. Danielson.

Chamlin, M. **Oculomotor paralysis with partial recovery.** Arch. of Ophth., 1946, v. 35, Jan., pp. 23-27.

A case of internal and external ophthalmoplegia due to paralysis of the third nerve is described.

Because of the internal ophthalmoplegia, an opportunity was afforded to study the effects of various drugs on the pupil during the paretic stage as well as during partial recovery. The reactions observed fit well into the present-day concept of the mode of action of the cholinergic and adrenergic drugs.

Although there was no increase in tension, the reaction to physostigmine resembles that of a glaucomatous eye.

The "pseudo-Graefe" phenomenon seen in the stage of recovery of paralysis of the third nerve is illustrated. This retraction of the paretic lid can be produced by having the patient attempt to look in directions other than the classic "down and in."

R. W. Danielson.

Donahue, H. C. **Complications of herpes zoster ophthalmicus.** Amer. Jour. Ophth., 1946, v. 29, May, pp. 582-585. (See Section 14, Eyelids and lacrimal apparatus.)

Feigenbaum, A., and Kornblueth, W. **Paralysis of convergence with bilateral ring scotoma following injury to oc-**

cipital region. Arch. of Ophth., 1946, v. 35, March, pp. 218-226.

A case of convergence paralysis after trauma in the occipital region is described. Accommodation and the near-point reaction ("convergence reaction") of the pupils were intact; the independence of the near-point reaction of accommodation and of convergence is once more stressed. The localization of the supranuclear convergence centers in the occipital region of the brain near the visual cortex is confirmed.

A remarkable finding in the field of vision of both eyes was a persistent, though inconstant, ring scotoma. Fatigability, caused by general damage to the striate areas, is assumed to be the basis of this disturbance in the fields, which is fairly regularly associated with an injury to the occipital region of the head. (References.)

R. W. Danielson.

Ferree, C. E., and Rand, G. **Examination of ocular aptitude and of ocular and general fatigue in aviators.** Arch. d'Ophth., 1945, v. 5, no. 3, p. 297.

The authors describe an instrument known as a tachytoscope designed for the purpose of testing visual aptitude, particularly in skilled machine workers and aviators. Ordinary ophthalmologic tests completely ignore the important factors of accommodation speed, convergence and divergence facility, and oculomotor adaptation in the different directions of gaze. The authors stress that general nervous fatigue is readily recognized by its effect on eye function. The instrument allows a series of tests to be made and provides a performance curve of the results which can become a permanent part of the individual's record. In addition to its function in detecting oculomotor abnormalities, the instrument can also be

used for training, in the presence of oculomotor deficiencies.

Phillips Thygeson.

Grieve, John. Relative incidence of sternomastoid and ocular torticollis in aircrew recruits. *Brit. Jour. Surg.*, 1946, v. 33, Jan., p. 285.

The author found 16 cases of ocular torticollis, characterized by a head tilt associated with hyperphoria (or hypertropia), in a survey of 9,500 aviation recruits. In this group there were only two persons with sternomastoid torticollis and none with spastic torticollis.

The differential diagnosis of ocular and sternomastoid torticollis is discussed briefly. The latter is characterized by facial asymmetry, and a contracted sternomastoid muscle, and resistance to passive straightening. The face looks away from the side of the head tilt and the ocular-muscle balance is normal. In the ocular type, a vertical-ocular-muscle imbalance is always present, conjugate ocular movements are affected, the face looks toward the side of the head tilt, and passive straightening of the head is possible.

As evidence of the prevailing tendency to disregard ocular-muscle imbalance in the diagnosis of torticollis, the author cites statistics from an orthopedic hospital which reported 108 cases of sternomastoid torticollis, as opposed to two eye hospitals which reported 33 cases of ocular torticollis and only two of the sternomastoid type.

In the absence of a readily demonstrated sternomastoid contraction, the ocular muscles must be studied carefully.

Benjamin Milder.

Herzsu, W. Horror fusionis and aniseikonia after trauma. *Klin. M. f. Augenli.*, 1943, v. 109, March-April, p.

193. (See Section 3, Physiologic optics, refraction, and color vision.)

Kirby, D. B. Paralysis of ocular elevation with and without ptosis. *Arch. of Ophth.*, 1946, v. 35, March, pp. 199-217.

The conditions of paralysis of ocular elevation with and without ptosis are described, and various cases illustrating the different types (based on the muscle that is paralyzed) are reported. The purpose of the paper is to clarify the indication for, and the technique of surgical procedures which may be useful in correcting the heterotropia and the ptosis. The heterotropia manifests itself as a hypotropia of the paretic eye or a hypertropia of the sound eye that develops when the paretic eye prefers to fixate. A differentiation is made between real ptosis and pseudoptosis.

The following conditions are evaluated from the surgical standpoint: (1) paralysis of the superior rectus muscle alone, (2) paralysis of the inferior oblique muscle alone, (3) unilateral paralysis of the superior rectus and inferior oblique muscles, (4) bilateral paralysis of both superior rectus and inferior oblique muscles, and (5) bilateral complete external ophthalmoplegia. In all these conditions the association of ptosis is considered. The surgical correction that is possible; the procedures that are feasible, and the methods used in applying the principles of reconstructive surgery to these conditions and the actual results obtained in the cases reported are described.

James W. White, in discussion, records seven case reports.

R. W. Danielson.

Mann, Ida. Exophthalmic ophthalmoplegia and its relation to thyro-

toxicosis. *Amer. Jour. Ophth.*, 1946, v. 29, June, pp. 645-654. (See Section 13, Eyeball and orbit.)

Morgan, G. E. *Amblyopia ex anopsia in the Armed Forces.* *Amer. Jour. Ophth.*, 1946, v. 29, June, pp. 713-717. (References.)

Papoleczy, E. *The congenital and hereditary paresis of eye muscles.* *Klin. M. f. Augenh.*, 1943, v. 100, Jan.-Feb., p. 77.

Two cases of congenital ophthalmoplegia are reported. A man aged 20 years, whose eyes had been paralyzed since birth, was highly myopic and amblyopic in both eyes. All eye movements were absent, and he had divergent strabismus and rotary nystagmus in the left eye. In each eye the fundus was normal except for a temporal conus. He was left-handed. A neurologic examination was negative, and there was no indication that the anomaly was hereditary.

In a woman, aged 19 years, both eyes were paralyzed since birth. She had bilateral ptosis and moderate myopic astigmatism and amblyopia in both eyes. Both superior rectus muscles were completely paralyzed, and the external and internal rectus muscle was partially paralyzed in each eye. There were no neurologic findings. The patient's father, one sister, and two brothers have a similar condition. It is assumed that these anomalies of development are produced by pressure of the fluid in the primary vesicle of the embryonic brain during the fourth or fifth week of fetal life. The nuclei of the nerves which innervate the levator of the upper lid and the superior rectus muscle, the muscles which are paralyzed most frequently, are particularly exposed to this pressure. (References.)

F. Nelson.

Rebello Machado, Nicolino. *Heterophorias.* *Rev. Brasileira de Oft.*, 1946, v. 4, March, pp. 195-224.

This 29-page general discussion of the subject is accompanied by description of various classical tests and a brief outline of treatment. (8 figures, references.) W. H. Crisp.

Redlich, F. C., Callahan, A., and Schmedtje, J. F. *Electrical potentials from eye movements.* *Yale Jour. Biol. and Med.*, 1946, v. 18, March, p. 269.

Previous investigators who used frontal skin leads on the electroencephalograph have demonstrated changes in electric potential during blinking and other lid movements. These "blink waves" have been considered to be due to a potential difference between the cornea and retina. They are greatest when the optic axis is aligned with the leads, and disappear completely when the retina is destroyed, or after evisceration or enucleation.

A study of variations in potential, during blinking, ocular movements, and pressure on the bulb, was made in 40 patients who had a variety of ocular conditions. The "blink waves" varied with the frequency and strength of blinking; they were not affected by disease of the retina or optic nerve (even when there was no light perception); but they were abolished in evisceration and enucleation. Pressure on a normal globe produced a similar electrical discharge.

No explanation of the source of the corneo-retinal potential is offered.

Benjamin Milder.

Spiegel, E. A., and Scala, N. P. *Changes in labyrinthine excitability in lesions of optic tract or external geniculate body.* *Arch. of Ophth.*, 1945, v. 34, Nov.-Dec., pp. 408-410.

Lesions of the optic tract or of the external geniculate body were produced electrolytically in cats or the optic tract was cut. Following these operations a marked difference was noted between the postrotatory nystagmus following clockwise rotation and that following counterclockwise rotation. The postrotatory nystagmoid movements toward the side operated upon lasted up to three times as long as those toward the normal side, and there were as many as four times as many jerks. These observations seem to indicate that impulses from the homolateral halves of the retinas have an inhibitory effect on vestibular-ocular reflexes that produce nystagmus to the same side. (2 illustrations.)

John C. Long.

Swann, L. A. **Comments on the cover test.** *The Optician*, 1946, v. 110, Jan. 18, pp. 451-453.

The cover test reveals the speed of fusion recovery. Three conditions of recovery are met; namely, quick or slow recovery, and apparent latency (no movement). The test can be applied in any part of the motor field and can be used to determine the near point of convergence objectively and subjectively.

I. E. Gaynon.

5

CONJUNCTIVA

Allen, J. H., and Erdman, G. L. **Meningococcic keratoconjunctivitis.** *Amer. Jour. Ophth.*, 1946, v. 29, June, pp. 721-723. (1 table, references.)

Alvarez, Abundio. **Bulbar vernal conjunctivitis and its relation to allergies.** *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, pp. 185-199.

The clinical and pathologic picture

of a limbal type of vernal conjunctivitis is presented. The allergic character of the condition seems established.

J. Wesley McKinney.

Lewis, P. M. **Penicillin in gonococic conjunctivitis; its use in 30 cases, compared with the sulfonamides in 173 cases.** *Amer. Jour. Ophth.*, 1946, v. 29, June, pp. 694-698. (3 tables, references.)

Magitot, A. **Allergic conjunctivitis and keratitis.** *Ann. d'Ocul.*, 1945, v. 178, Aug., pp. 321-334.

In this comprehensive outline allergies are classified according to: (1) the physical or chemical nature of the allergen; (2) the places of contact; (3) the time of origin, whether congenital or acquired.

The effect of histamine is illustrated by Bruce's experiment in which the application of oil of mustard is without irritative reaction if the conjunctiva is previously anesthetized with cocaine. In gonococcal iritis pain is decreased and healing increased after alcohol injection of the ciliary ganglion. The phenomenon of Wessely illustrates the allergic character of interstitial keratitis: a corneal reaction very similar to interstitial keratitis in one eye follows a heterogenous corneal serum injection into the other eye if the first eye has been sensitized by a similar corneal injection two weeks previously. The success of keratoplasties depends partly upon allergic reactions; a larger proportion of failures follows pneumococcal and streptococcal infections.

Conjunctival allergies may be divided into four groups:

1. Acute, often associated with conjunctival eosinophilia, positive Prausnitz-Küstner test and negative patch tests.

2. Subacute or follicular reactions,

which include reactions to drugs, in which cutaneous and Prausnitz-Küstner tests may be negative.

3. Purely ocular reactions associated with follicular hypertrophy after contact with pollens, animal and bacterial products, and cosmetics. Spring catarrh is included in this group and its relation to endocrine dysfunction and vasosympathetic sensibility is mentioned. There are hundreds of allergens.

4. Infectious allergies. Staphylococcal allergies are classified into hemolytic and nonhemolytic of which the latter are found in styes and similar infections, the former, in chronic blepharoconjunctivitis, and this is frequently associated with a similar infection of the nose, sinuses and pharynx. Streptococcal allergies are of two types; the first is provoked by culture filtrates which produce an immediate skin reaction, and the second by dead bacteria. Tuberculosis allergies include phlyctenular keratoconjunctivitis, the infantile form of which is sharply differentiated from the adult form. In the former, basic tuberculous allergy almost always exists. In the adult form skin reactions to the tubercle bacilli are frequently negative. The condition is frequently recurrent and is associated with similar inflammatory lesions in the nasopharynx. Various toxic agents are a third factor in this complex reaction. In an illustrative case prompt recovery followed discontinuance of the use of barbiturates. (20 references.) Chas. A. Bahn.

Prado, Durval. Strange ocular complication caused from intoxication by sulfadiazine. *Arquivos Brasileiros de Oft.*, 1945, v. 8, Dec., pp. 169-172.

A medical undergraduate aged 24 years had a gonococcic urethral infection for which he ingested sulfadiazine

in a daily dosage varying from two to five grams for a total of three weeks, and without taking at the same time an alkalizing or other antitoxic drug. Five days later he developed a severe conjunctival irritation with slight photophobia and lacrimation. The next day he had a strong febrile reaction, and in the nasolabial fold there were a number of phlyctenules of the approximate size of the head of a match, with slight edema of the face. The second day after hospitalization the phlyctenular eruption spread over the whole body, and there was headache with weakness. The diagnosis wavered between smallpox and an allergic reaction. The subsequent treatment included nicotinic acid, vitamin C, and glyco-physiologic fluid by vein. Further symptoms included abundant thick and viscous salivation, nasal obstruction, occlusion of the eyelids with production of abundant conjunctival exudate, and an analogous condition of the nose. The bodily eruption broke down into small ulcers, which became covered with crusts, and these developed into irregularly pigmented spots of various sizes. Leukopenia and monocytosis supported the diagnosis of sulfamide intoxication. The twenty-second day of hospitalization the patient was discharged from the hospital still bearing the pigmented spots over the body. Two days later he began to lose the toenails and fingernails. These were subsequently regenerated, and the bodily spots lost their pigmentation. The corrected vision became normal, although photophobia and lacrimation continued for some time. There was symblepharon at both angles of each eye. (1 illustration.) W. H. Crisp.

Selfa, Enrique. Pseudomembranous conjunctivitis in whooping cough.

Arch. de la Soc. Oft. Hisp.-Amer., 1945, v. 5, March, pp. 200-205.

Acute conjunctivitis in whooping cough has two forms: (1) a toxic pseudomembranous form easily confused with diphtheritic conjunctivitis, and (2) a metastatic form which is not different from the usual acute conjunctivitis. Both types are benign and clear up without treatment in two to five days. Eight cases are reported; in one of the patients corneal ulcers developed, presumably as a result of overtreatment.

J. Wesley McKinney.

Siniscal, A. A. Oculoglandular tularmia. Amer. Jour. Ophth., 1946, v. 29, June, pp. 698-710. (References.)

6

CORNEA AND SCLERA

Allen, J. H., and Erdman, G. L. Meningococcic keratoconjunctivitis. Amer. Jour. Ophth., 1946, v. 29, June, pp. 721-723. (See Section 5, Conjunctiva.)

Arruga, H. An instrument for keratoplasty. Arch. of Ophth., 1946, v. 35, March, pp. 299-300.

In passing sutures through a corneal transplant, there is always a certain amount of trauma. Arruga here describes an instrument devised to reduce the bruising to a minimum.

The sutures leave minute spots in the corneal graft, but in the great majority of cases these spots are invisible to the naked eye and do not impair the transparency of the corneal graft.

R. W. Danielson.

Arruga, H. Some modification in the fixation of the transplant in keratoplasty. Ophthalmologica, 1945, v. 109, April-May, pp. 269-270.

The author suggests a modification in the sutures by means of which the transplanted cornea is fixed directly to the cornea of the host. With very fine needles two sutures are placed, opposite to each other, and 1 mm. from the margin of the transplant. A suture is placed in the cornea of the patient before the diseased part is removed by a 4-mm. trephine. The graft is put into the defect with the sutures in the 12 and 6 o'clock positions. These sutures are also put through the margins of the wound in the cornea of the patient and knotted. The graft is pushed back with extreme care and the primary suture tied over the center of the transplant.

Alice R. Deutsch.

Falls, H. F., and Beall, J. G. Ocular varicella. Arch. of Ophth., 1945, v. 34, Nov.-Dec., pp. 411-412.

The ocular complications of varicella (chicken-pox) are rare. Usually these complications occur late in the course of the disease, the area involved is small and circumscribed, associated iridocyclitis is absent, and recovery is rapid and complete.

A physician, 30 years of age, developed ocular complications on approximately the seventh day of a severe attack of varicella. The conjunctiva of each eye revealed several small vesicular areas, each of which possessed a small areola of hyperemia. There was suggestive corneal anesthesia of the left eye. Both corneas showed a few scattered pinpoint areas which stained with fluorescein. In addition, the left cornea showed a definite zone of infiltration one-half to one millimeter in diameter and one to two millimeters from the limbus. This area was raised and stained diffusely with fluorescein. The cornea was thickened superficially, but no deep lesion could be seen. No

aqueous flare was noted. The zone of infiltration surrounding the phlyctenule receded rather promptly. The phlyctenule disappeared within a period of six to seven days, but slight corneal anesthesia persisted for at least ten days. Complete recovery occurred within a month after the onset of the ocular lesion. (Colored drawing.)

John C. Long.

Franceschetti, A., and Babel, J. A tentative anatomical classification of familial corneal degenerations. *Ophthalmologica*, 1945, v. 109, April-May, pp. 169-202.

This detailed study of the familial corneal degenerations is based on the histologic examinations of 14 corneas. The histologic findings are readily grouped to correspond to the clinically recognized types of dystrophy. In the first group, which consists of the lesions that are progressive and not congenital, there are two types that are dominant in hereditary pattern and one that is recessive. The two dominant forms—the granular and the lattice—are histologically characterized by a hyaline degeneration of the superficial lamellae of the corneal stroma and more particularly by the subepithelial deposition of a basophilic hyaline substance. The lattice form differs from the granular in that the degenerative changes in the stroma involve deeper strata and that the basophilic hyaline appears in larger masses. A third type, which is recessive and is called macular dystrophy, shows similar hyaline degeneration of the lamellae, and a granular albuminous substance is found in all the cells (stroma, epithelium, endothelium).

In the second group the dystrophies are congenital and stationary. One finds no hyaline degeneration, but instead, a

dissociation of the lamellae of the stroma and the deposition of a granular substance that may be a lipoid in the cells of the stroma. In the majority of cases the hereditary pattern is of the recessive type. Chemically and histologically the lesion is similar to that found in dysostosis multiplex (Gargoylism). (15 illustrations, 3 in color, bibliography.)

Alice R. Deutsch.

Giraudet, M. New instruments for keratoplasty. *Ophthalmologica*, 1945, v. 110, July-Aug., pp. 34-37.

The five new instruments which are presented in this paper were designed to help in the difficult procedures of keratoplasty. In using them it is not necessary to make any changes in the technique of the operation. (3 figures.)

Alice R. Deutsch.

Greene, P. B. *Keratoconus posticus circumscriptus*. *Arch. of Ophth.*, 1945, v. 34, Nov.-Dec., pp. 432-433.

A sixth case of *keratoconus posticus circumscriptus* is described in one eye of a man who was 52 years of age. Just nasal to the center of the cornea the posterior surface of the cornea curved sharply forward so that the resultant thickness of the cornea at this point was about one-third that of the surrounding normal tissue. A nebula surrounded this area. In addition there was a small anterior subcapsular lens opacity and a somewhat larger opacity on the face of the fetal nucleus. All three of these opacities were in a direct line. It is possible that this condition represents a delayed separation of the lens from the cornea and is an aberration in development, although intrauterine inflammation may be considered a possible cause.

John C. Long.

NEWS ITEMS

Edited by DONALD J. LYLE, M.D.

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News items should reach the editor by the twelfth of the month

DEATHS

Dr. Henry Nathan Blum, New Orleans, Louisiana, died April 13, 1946, aged 69 years.

Dr. George Walter Caldwell, Los Angeles, California, died March 11, 1946, aged 79 years.

Dr. Hal Lovelace Foster, Kansas City, Missouri, died May 21, 1946, aged 87 years.

Dr. Charles Joseph V. Fries, Jr., Philadelphia, Pennsylvania, died May 7, 1946, aged 55 years.

Dr. Rufus Jackson, Baton Rouge, Louisiana, died February 21, 1946, aged 62 years.

Dr. Cassius D. Wescott, Chicago, Illinois, died May 6, 1946, aged 84 years.

MISCELLANEOUS

Operative surgical clinics in 17 Detroit hospitals will be featured the first morning of the eleventh assembly of the United States Chapter, International College of Surgeons, to be held in Detroit, October 21-22-23, 1946.

Special arrangements have been made to demonstrate the advances in gastric, thoracic, biliary, intestinal, genito-urinary, and plastic surgery. The various specialties, such as, ophthalmology, otolaryngology, and gynecology, the modern treatment of burns, fractures, and modern uses of wire in surgery will be featured.

For information concerning the Detroit Assembly or the primary qualifications for Fellowship in the United States Chapter, International College of Surgeons, write Dr. L. J. Garipey, secretary, 16401 Grank River Avenue, Detroit 27, Michigan.

At the annual meeting of the Better Vision Institute, June 28th, at the Park Lane Hotel, New York, new directors were elected. To represent the Manufacturer Group to June, 1948: Beverly Chew, C. O. Cozzens, J. E. Hansen, and Ben Ramaker. To represent the Supply House Group to June, 1948: Thomas Bryne, S. H. Edelstein, Roy Martin and C. N. Shelden. To represent the Optometric Group to June, 1948: Dr. John F. Hill, Dr. John Hughes, Dr. W. E. Malinka, and Dr. J. A. Palmer. To represent the Ophthalmic Dispensers' Group to June, 1948: W. A. Blocker, William Cook, J. A. T. Obrig, and A. F. Weber.

Directors whose terms carry over to 1947 are: In the Manufacturer Group: A. M. Krementz, Nathaniel Singer, M. H. Stanley, and E. H. Titmus; in the Supply House Group: W. B. Jones, Art Hager, H. E. McClenaghan, and Aaron Potter; in the Optometric Group:

Dr. Walter I. Brown, Dr. John J. O'Neil, Dr. F. A. Seward, and Dr. Jesse Wheeler; and in the Ophthalmic Dispensers' Group: H. B. Carpenter, Harry Chisholm, Oscar Cleal, and Henry Keller. Elected for one year to the Finance Committee were Beverly Chew, J. F. Taylor, Roy Martin, Aaron Potter, Dr. John F. Hill, and W. A. Blocker.

New industrial posters, to be released to industrial plants throughout the country for bulletin board use, will stress to workers: (1) the need for better vision in factory work; and (2) the need for protective goggles in hazardous occupations.

Under the title, The Treacher Collins Prize Essay, the Council of the Ophthalmological Society of the United Kingdom has instituted a prize of £100, awarded triennially, for the best essay submitted upon a subject to be selected by the Council. The prize shall be open to qualified medical practitioners of any nationality, and the essay shall be written in the English language.

The subject for the next award of the prize is: "Nutritional eye disease." The closing date for sending in essays for this award is December 31, 1947. Essays should be submitted to the Honorary Secretary, Ophthalmological Society of the United Kingdom, 5 Racquet Court, Fleet Street, E.C.4, from whom also any further particulars can be obtained. No name should be on any essay, but a distinguishing pseudonym or quotation, which should also be upon a sealed envelope containing the candidate's name and address. This envelope should accompany the essay.

SOCIETIES

The North Dakota Academy of Ophthalmology and Otolaryngology held its annual meeting at Bismarck, May 28th. Dr. H. L. Bair of Rochester, Minnesota, and Dr. M. T. Lampert of Minot, North Dakota, addressed the society on "Newer therapeutic measures in ophthalmology" and "Glaucoma, its mechanism."

The following officers were elected for the year 1946-47: E. D. Perrin of Bismarck, president; Dr. H. L. Reichert of Dickinson, vice-president; and Dr. M. T. Lampert of Minot, secretary.

An all-day meeting of the Reading Eye, Ear, Nose, and Throat Society was held at Reading Hospital, June 19th. Wet and dry clinics were held, followed by a paper by Dr. Francis Heed Adler and a paper by Dr. Harry P. Schenck.

At the annual meeting of the Pennsylvania Academy of Ophthalmology and Otolaryngology, held at the Merion Golf Club, Philadelphia, April 24-25, 1946, the following essays of ophthalmic interest were presented: "Some interesting phases of war ophthalmology," by James N. Greear, Jr., M.D.; "Anesthesia in Ophthalmology," by Walter S. Atkinson, M.D., and "Retinal arteriolar sclerosis," by Walter I. Lillie, M.D.

PERSONALS

On June 19th, at its eighty-eighth annual commencement, Northwestern University conferred the honorary degree of Doctor of Science upon Sir Stewart Duke-Elder. His citation read as follows:

"World-famed ophthalmologist, whose scientific researches have introduced significant conceptions of the nature and function of various ocular tissues; an ophthalmic surgeon of great skill and resourcefulness, who served his country during the war as Chief Consulting Ophthalmic Surgeon to the British Army; companion and advisor to ophthalmic medical offi-

cers of the United States Army stationed in Great Britain during the war; sole author of the world's most distinguished textbook on Ophthalmology."

Sir Stewart was presented by Dr. Derrick Vail, Professor and Chairman of the Department of Ophthalmology, Northwestern University.

Following the death of Dr. Mark J. Schoenberg, The National Society for the Prevention of Blindness announces the appointment of Dr. Willis S. Knighton as its chairman of the Committee on Glaucoma. With the guidance of the Committee, the direction of the demonstration glaucoma clinic, Manhattan Eye, Ear, and Throat Hospital of New York City has been assumed by Dr. Ferdinand L. P. Koch.

Dr. Rodolph M. Cutino, Brooklyn, has been appointed clinical professor of ophthalmology, and Dr. Mortimer A. Lasky has been promoted to clinical professor of ophthalmology at the Long Island College of Medicine, Brooklyn, New York.

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TREATMENT OF GLAUCOMA WITH DI-ISOPROPYL
FLUOROPHOSPHATE (D.F.P.)*

PHILLIP ROBB McDONALD, M.D.

Philadelphia

Every ophthalmologist will agree that the treatment of glaucoma is frequently a difficult and harrowing problem. This is attested to by the numerous articles published every year dealing with the different aspects of this serious condition. The signs and symptoms of glaucoma are fairly uniform, but there can be no uniformity of treatment whether medical or surgical. Though numerous operative procedures have been devised for the relief of this ocular hypertension, it has only been within the past few years that drugs other than pilocarpine or eserine have been added to the physicians' therapeutic armamentarium.

Of the newer therapeutic agents, prostigmine acts like its chemical progenitor physostigmine or eserine in inhibiting the hydrolytic action of cholinesterase. Mecholyl, doryl, and furmethide are related chemically and act like acetylcholine in producing parasympathetic stimulation. The fact that none of these drugs is entirely successful in the relief of glaucoma is probably due to the fact that we are treating the patient by reason of objective findings, knowing little, if anything, of the etiologic basis for the disturbance. Previous studies^{1,2} have suggested that in patients with glaucoma there is some disturbance of the acetylcholine-cholinesterase balance.

Within the past few months a new

miotic has been introduced which gives great promise as a valuable adjunct in the treatment of glaucoma. This is di-isopropyl fluorophosphate (D.F.P.), one of a large group of fluorophosphates, and there is every reason to expect that other and probably more efficient miotics of a similar chemical structure may be introduced. Leopold and Comroe^{3,4} were the first to report on the effect of D.F.P. in the normal and glaucomatous eye. This drug is similar to eserine and prostigmine in inhibiting the cholinesterase. It is at least five-and-one-half times more potent and persistent than eserine. This may be due to the fact that its action is irreversible; that is, the cholinesterase is completely destroyed.

Leopold and Comroe have shown that, in the normal and glaucomatous eye, D.F.P. causes prolonged and marked miosis, ciliary spasm, false myopia, and a decrease in the intraocular pressure. This effect is not restricted to D.F.P., but has been reported as the property of other miotics.⁴ However, in the work referred to, D.F.P. miosis in the normal eye was found to persist for 14 to 27 days.

The studies herewith reported confirm the findings of these investigators³ in every detail. As recommended by them, the drug was used in a solution of peanut oil in concentrations of .05, .1, .2 percent. Peanut oil is used as the vehicle, for in an aqueous solution the potency of the drug is lost in about seven days.

*From Wills Hospital.

The present investigation was carried out to determine the advantages and disadvantages of using this drug routinely on clinic patients. In order to prove or disprove the efficacy of this drug over other miotics only those patients (with two exceptions) whose glaucoma was uncontrolled by the use of pilocarpine and/or eserine were accepted for trial. Cases in which the tension consistently ran greater than 30 mm. Hg (Schiotz) were considered as uncontrolled. The greatest percentage of cases fell in the group classified as chronic simple glaucoma. Some of the patients had fairly high tensions (60 to 70 mm. Hg), but no cases of primary acute congestive glaucoma are included in this series. The few cases that were seen responded to the usual miotic therapy.

PROCEDURE

The patients were all examined by me and the only cases rejected for therapy were those with blind painful eyes whose misery the drug might increase, or those who because of infirmities or geographic location could not return for observation every three to six days. The routine procedure was to have the patient's vision and tension checked. One drop of 0.1-percent D.F.P. was then instilled in the glaucomatous eye or eyes. After 45 minutes had elapsed, the tension was rechecked. In practically every instance, within this period of time, the tension was considerably lower. In a few cases there was some pericorneal injection; in patients whose iris was intact the miosis was usually pronounced. The patients were told to discontinue all previous medication and were given .1-percent D.F.P. to use either twice or three times a day, depending on their primary response. They were advised to expect some brow or eye ache and told that it might be severe. Aspirin was recommended for the relief of the discomfort.

With few exceptions all patients were examined again in 48 and 72 hours. On re-examination a number of patients stated that they had not used the drug or that they had used it only once since the initial drop.

In practically every instance the tension was lower than it had been initially, and, except for 10 patients who steadfastly refused therapy, all were willing to continue. The seriousness of their condition was explained to them, and it was pointed out that this was the first time in quite an interval that their tension had been controlled. At the second visit, if the tension had been satisfactorily reduced, the patients were instructed to use one drop of D.F.P. either once a day or every other day—if the tension was on the borderline, they were requested to use the drug three times a day. If the patients were insistent that the medicine was too strong, they were given .05-percent D.F.P. Those that complained of loss of vision were shown by means of a -1.00 or $-1.50D.$ sphere held in front of their lens that the decrease in visual acuity was brought about by a change in the refractive error.

At the time of the 72-hour visit one could obtain a fairly good estimate as to whether the patient's condition was controlled or not. At this time the frequency of the medication was again increased or decreased. Those who were still in an uncontrolled state were either given .2-percent D.F.P. to try for another 48 hours, returned to their old miotic, or admitted to the hospital for surgical intervention. Most of the patients were seen at weekly intervals for the first month and then every two to three weeks for the duration of this study. After the first week, most of the discomfort had abated, the blurring of vision was less noticeable, and the patients were, on the whole, content to continue the new therapy. Many

of them were quite pleased to be able to get along on one or less drops a day. This group was instructed to use the medicine at night so that the blurring of vision would be less disturbing.

RESULTS

The results of this study are summarized in table 1. The patients have been divided into two groups, controlled and not controlled. The data on white and colored patients have been separated to determine if there was any difference in the effect of the drug, since it is well known that persons of the colored race are more resistant to therapy. It will be noted that 82 patients have been seen and 122 eyes have been treated. Five of the patients, three white and two colored, had one eye controlled and the other not. The criteria for control was a tension consistently below 30 mm. Hg (Schiotz)—two tonometric readings of 30 mm. or above during the four months' period placed the patient in the category of having uncontrolled glaucoma.

Several interesting features are presented by these data. It is noteworthy that 57.4 percent of the patients' glaucomatous condition was considered as uncontrolled. Since it had been controlled in none of them by means of miotic or miotics previously used, the results speak well for the drug. Of the eyes that were controlled, 30 percent had a vision of less than 1/60; of the uncontrolled group, however, 50 percent had vision of 1/60 or less. This is not surprising, for in any clinic the patients with absolute or advanced glaucoma represent a fair proportion of the group that is uncontrolled.

In evaluating any therapy one cannot consider the effect of the drug alone, but must also consider the patient's tolerance of it. For this reason the 10 patients who refused therapy were considered as being uncontrolled. This group represents a

total of 14 eyes, half of which had a vision of 1/60 or less, and the other half 6/60 or better. In five of the seven eyes with vision 6/60 or better, the tension was satisfactorily reduced following the initial therapy; the tension was still reduced at the end of 48 hours despite the fact that only one or no drops had been used at home. The patients, however, were adamant in refusing further therapy. Those with blind eyes were encouraged but not coaxed to continue D.F.P. Neither approach was of any avail.

FREQUENCY AND STRENGTH OF MEDICATION

The distinct advantages of this drug are its relative potency and prolonged ac-

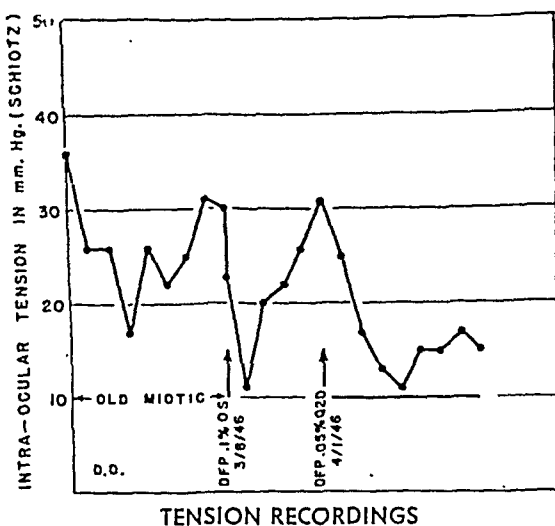


Fig. 1 (McDonald). Colored man, aged 59 years. Glaucoma first diagnosed June 15, 1945. Visual fields show peripheral contraction with nasal step O.S. Prior to D.F.P. therapy, V.O.D. 6/9 + 1; V.O.S. 6/12 + 1 without correction. Vision after four months' therapy, O.D. 6/9 + 2; O.S. 6/6 without correction. No significant change in visual field.

tion. Leopold and Comroe have pointed out that miosis in glaucomatous eyes is much more prolonged than that produced by any other miotic and that it is even more prolonged in the normal eye. Of the group who were controlled, approxi-

mately 63 percent required only one to seven drops of 0.1-percent D.F.P. a week. The prolonged effect of this drug can be

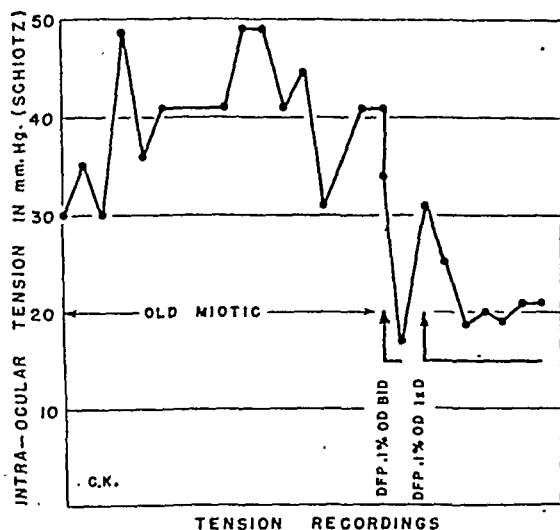


Fig. 2 (McDonald). White man, aged 74 years. Glaucoma first diagnosed May 23, 1944. Elliot trephining O.S. April 13, 1945. Visual fields show peripheral contraction with nasal step. Prior to D.F.P. therapy, uncorrected V.O.D. 6/15; corrected 6/6. Vision after four months' therapy uncorrected, O.D. 6/9—1; corrected 6/9. Visual fields unchanged.

seen in figure 1. This colored patient received one drop of 0.1-percent D.F.P. in his left eye in the clinic on March 8, 1946, but because of the discomfort it brought on he did not use the medication at home. Twenty-three days elapsed before the tension rose to its previous level. He was subsequently placed on 0.05-percent D.F.P. and now tolerates 0.1 percent without difficulty. One drop a week now maintains his tension at a satisfactory level.

This is not always the case, as can be seen in figures 2 and 3. After one week of therapy (fig. 2) this patient was returned to his previous miotic, and within four days his tension had risen to 31 mm. Hg (Schiotz). He is now satisfactorily controlled with one drop of 0.1-percent D.F.P., daily. The individual whose tension curve is shown in figure 3 did not use the medication after the ini-

tial drop in the clinic. When she returned, 96 hours later, the tension had risen but was still lower than it had been for several months. She is now well controlled on one drop a day.

The group who were uncontrolled were naturally all requested to use their drops more frequently. In a few instances, the drug was given more than three times a day; but it was found that, if a patient was not controlled on three drops a day, increasing the frequency was of no avail. This is to be expected because of the prolonged action of the drug.

The most satisfactory strength of D.F.P. to use routinely was found to be 0.1 percent; it was used initially in all cases. The strength was reduced to 0.05 percent if the patients complained too bitterly or increased to 0.2 percent if the tension was not satisfactorily controlled.

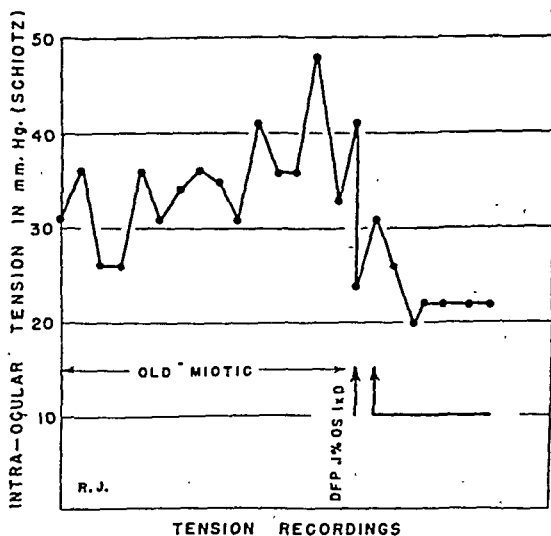


Fig. 3 (McDonald). White woman, aged 69 years. Glaucoma first diagnosed July 17, 1939. Visual field O.S. shows large Bjerrum scotoma. Uncorrected vision O.S., prior to and following therapy, 6/6. No change in visual field.

It was found that reducing the strength of the drug was no more effective than reducing the frequency plus some persuasive argument. Likewise, if a patient was not controlled with 0.1-percent D.F.P., he

was not likely to be controlled with a stronger solution. Of the group of patients now controlled, only one is using 0.2-percent D.F.P. The majority of those that are uncontrolled have been tried with 0.2-percent D.F.P. at some time or other.

FALL IN TENSION

The efficacy of any miotic is determined by its ability to reduce the ocular tension. This reduction in tension must be maintained within the accepted limits

of a week or so, the tension would gradually rise—in the controlled cases to a level in the low twenties; and in the uncontrolled cases, although not under 30 mm. Hg, in most instances to a level considerably lower than before. Figures 4 and 5 show the characteristic reduction in tension that has been maintained in the group that has been controlled. Figure 6 shows the precipitous drop in tension in response to both mecholyl and prostigmine and to D.F.P., yet, despite

TABLE 1
DATA ON 182 PATIENTS RECEIVING D.F.P. THERAPY

	No. of Pa- tients*	No. of Eyes	Vision less than 1/60	Refusing Therapy		Vision less than 1/60	Glau- coma Opera- tions	Aphakic		Drops per Week			Aver. Init. Drop	Aver. 48-hr. Drop
				Pts.	Eyes			Pts.	Eyes	21 15	14 8	7 1		
<i>Controlled</i>														
White	26	41	15				12	9	11	5	11	25	12.1	18.7
Colored	16	29	6				9	3	5	3	7	19	9.2	15.9
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Total	42	70	21				21	12	16	8	18	44		
<i>Not Controlled</i>														
White	25	34	20	6	8	5	24	3	3	12	21	1	10.8	16.3
Colored	10	18	6	4	6	2	14			13	5		10.7	12.6
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Total	35	52	26	10	14	7	38	3	3	25	26	1		

* This column does not include the five patients in whom one eye was controlled and one was not.

if the patient is to continue on medical treatment. In an attempt to determine whether the immediate effect of D.F.P. was of any value in prognosticating whether the intraocular pressure could or could not be controlled with this therapy the immediate drop and 48-hour fall in tension has been summarized in table 1. Perusal of these figures shows that there are no significant differences for the two races in either the controlled or uncontrolled groups. It is obvious that for all groups the tension was lower after 48 hours of therapy. As is the case with other miotics, the initial drop was frequently precipitous and then, over a pe-

riod of a week or so, the tension would gradually rise—in the controlled cases to a level in the low twenties; and in the uncontrolled cases, although not under 30 mm. Hg, in most instances to a level considerably lower than before.

RISE IN TENSION

Eserine and prostigmine are known occasionally to cause a rise in tension in the normal and the glaucomatous eye. This may be caused by the vasodilatory effect of these drugs. Since D.F.P. is a much more powerful inhibitor of the cholinesterase, it might be expected that this would be noted more frequently. In the control group, seven eyes showed an initial rise in tension of 3 to 7 mm. Hg (Schiotz); all of this group, however, showed a satisfactory drop in tension at the end of 48

hours. In the uncontrolled group, 10 patients showed an initial rise of from 2 to 35 mm. Hg (Schiotz), and only one of this group showed an appreciable drop below his initial tension within 48 hours.

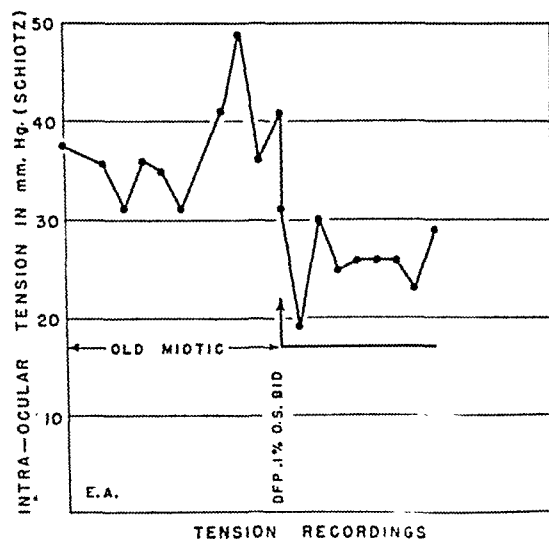


Fig. 4 (McDonald). Colored woman, aged 65 years. O.S. enucleated following glaucoma surgery in 1934. Glaucoma first diagnosed in O.D. February 14, 1934. Visual field shows small central island. Prior to therapy uncorrected and corrected V.O.D. 6/30+1. After four months of D.F.P. therapy corrected and uncorrected vision, 6/15. No change in visual field.

The significance of this will be discussed later.

APHAKIC GLAUCOMA

Of the entire group, the 15 patients with aphakic glaucoma were the most satisfactory to treat. This was so for several reasons. First, they seldom complained of discomfort. Leopold and Comroe² have pointed out that the probable reason for this is that the zonule is not intact, and they have also ingeniously surmised that the absence of pain supports the Tscherning theory that the fibers are stretched from ciliary spasm. Secondly, since accommodation is absent, these patients do not complain of blurring of vision. Lastly, the results have been uniformly successful in the uncomplicated cases. The tension record shown in figure 7 is characteristic of this group. This

patient developed glaucoma following an intracapsular cataract extraction and was admitted to the hospital for a cyclodialysis. When placed on D.F.P. the tension was immediately reduced. A cyclodialysis was performed when the tension was lowered. Following operation the tension rose to its original pre-D.F.P. level, and the drug was tried again with a satisfactory response. In order to insure that this reduction was not a delayed response to the operation, all medication was stopped for one week whereupon the tension rose again. It is now satisfactorily controlled by the use of one drop of 0.1-percent D.F.P. every other day.

As to the three failures, one patient had had a traumatic cataract removed eight years previously, the eye was blind, and there was a marked bullous keratitis. Another patient had had a cyclodialysis; when seen, the chamber was partially

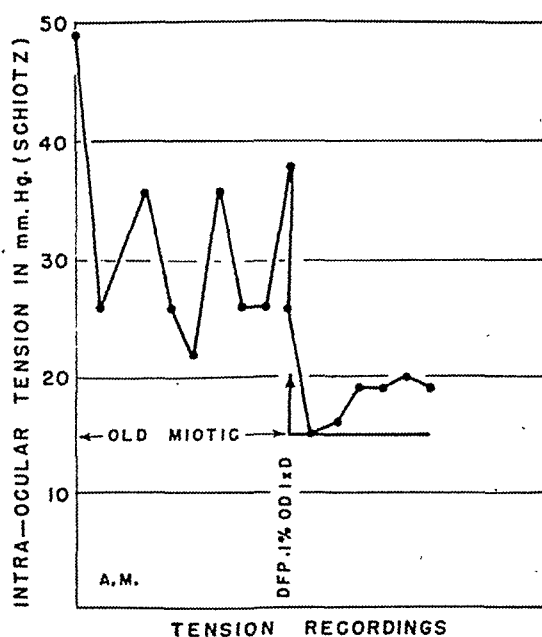


Fig. 5 (McDonald). White man, aged 53 years. Glaucoma first diagnosed in 1935. Ellipt trephining O.S. April 25, 1938. Visual field shows large Bjerrum scotoma O.D. Prior to therapy, corrected V.O.D. 6/21; V.O.S. nil. After D.F.P. therapy corrected V.O.D. 6/15-1. No change in visual field.

filled with blood and exudate. The third patient had had a secondary glaucoma with a dislocated lens; when seen, both pillars of the iris were incarcerated and the wound was bulging.

CAUSES OF FAILURE

All the cases have been reviewed critically to determine if there is any common denominator by means of which one could predict success or failure of the drug. As is frequently and unfortunately the case in a large series of clinic patients, the records are not complete enough to evaluate each case thoroughly—post-operative notes are incomplete, visual fields are not reliable, and there are

other omissions. Unfortunately, facilities for the gonioscopic examination of all these patients were not available. Visual fields, although taken, were sometimes missing, and differences in their record-

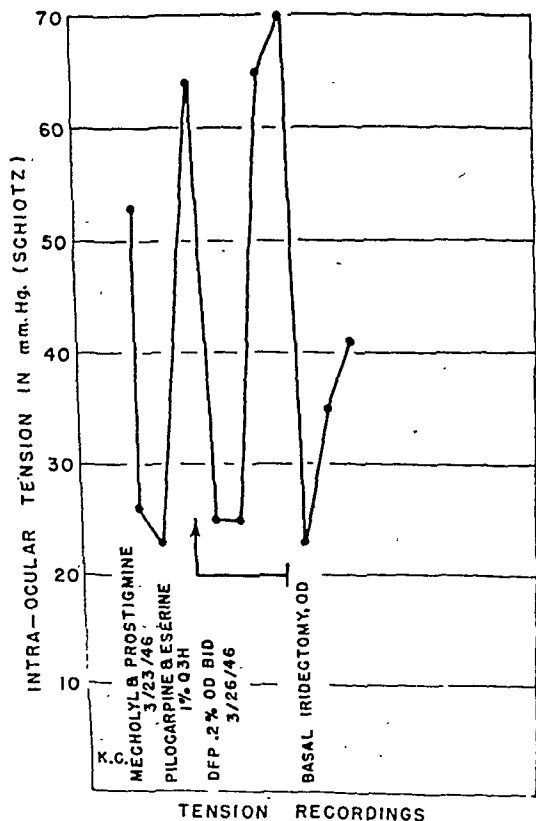


Fig. 6 (McDonald). White woman, aged 65 years. Glaucoma first diagnosed January 26, 1946. Basal iridectomy O.S., January 30, 1945. Visual field O.D. small central island. V.O.D. 1/60; V.O.S. nil. Basal iridectomy O.D., March 29, 1946. Patient has not been seen since discharge from hospital.

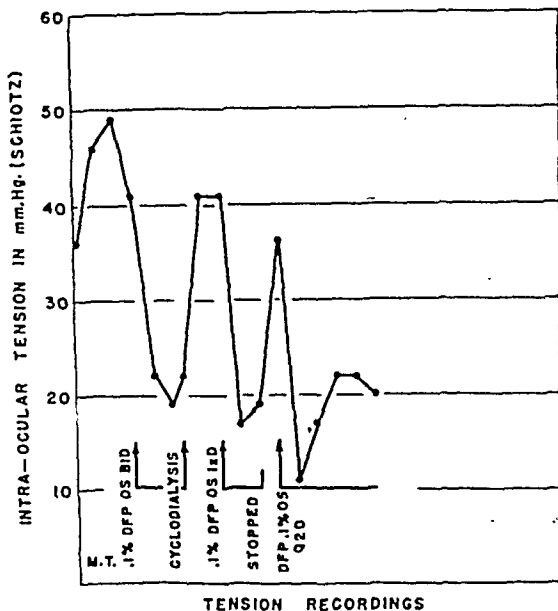


Fig. 7 (McDonald). White woman, aged 65 years. Intracapsular cataract extraction O.S., January 10, 1945. Glaucoma first diagnosed October 8, 1945. Cyclodialysis O.S., March 16, 1946. V.O.D. 6/12; no glaucoma, incipient cataract.

ing did not permit satisfactory comparisons.

As shown in table 1, 10 patients refused therapy because of the discomfort—a real objection to the use of D.F.P. This obstacle, however, could be partially overcome by having the patient hospitalized for the first few days of therapy, when adequate relief for the discomfort could be provided.

Of the uncontrolled group, eight patients with useful vision were admitted to the hospital and subsequently operated upon. Prior to operation, most of them had had every known type of therapy: mecholyl and prostigmine, furmethide, doryl, and D.F.P. None of these drugs satisfactorily lowered the tension. Of this group the condition of only two has

been satisfactorily controlled by operation; in the others, despite one to three operations on each eye, the tension is still uncontrolled. Two of these patients and one other not yet operated upon, I

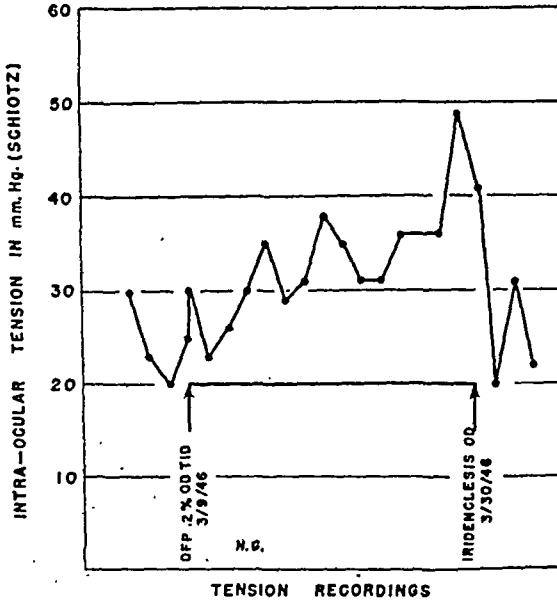


Fig. 8 (McDonald). White woman, aged 60 years. Glaucoma first diagnosed January 30, 1946. Corrected V.O.D. 6/9; V.O.S., light projection. Visual fields show small central island O.U. Patient has not been seen since discharge from hospital.

believe, have been made worse by the use of D.F.P. The patient whose tension curve of the right eye is shown in figure 8 had glaucoma in both eyes. She was admitted for surgery of the uncontrolled left eye. D.F.P. was ordered for both eyes to determine what effect it might have on the tension. Despite adequate miosis, the tension in both eyes started to climb and was relieved only by operation. The patient whose tension curve of the right eye is shown in figure 9 had an essential atrophy of the iris of the right eye. This eye was seemingly controlled with the old miotic; but the left eye, which had undergone a basal iridectomy, was not. The patient was placed on D.F.P. for the left eye and responded to the therapy. To simplify treatment, D.F.P.

was ordered for the right eye also. At no time has there been any miosis in this eye, and despite discontinuance of D.F.P. and a return to his old as well as other miotics, his tension in the right eye is still considerably higher than was recorded prior to therapy. The two other cases of atrophy of the iris in this series have also failed to respond to D.F.P. One case of glaucoma secondary to thrombosis of the central retinal vein was unaffected by the drug.

DISCUSSION

Considering the fact that, with two exceptions, only cases which were uncontrolled with the usual miotics are included

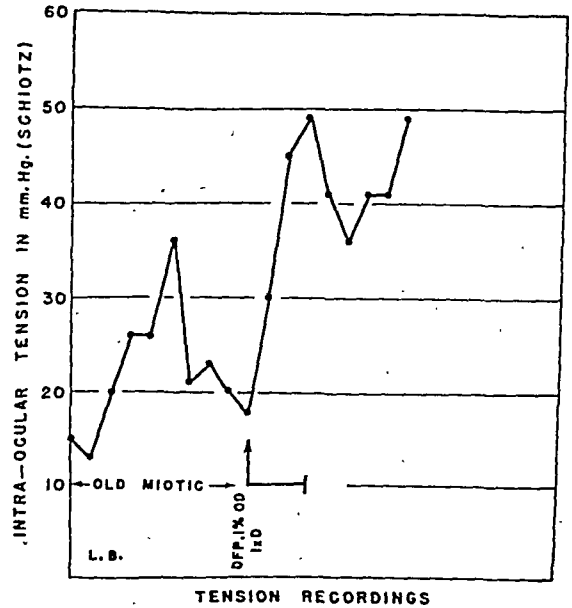


Fig. 9 (McDonald). White man, aged 58 years. Glaucoma first diagnosed September 11, 1944. Basal iridectomy O.S., September 19, 1944. Uncorrected V.O.D. 6/12; O.S. 6/9-1. Visual fields show small central island O.U. Visual acuity has not changed since therapy was initiated. Awaiting operation.

in this series the successful control of 57.4 percent of this group shows that D.F.P. is a valuable adjunct in the medical treatment of glaucoma. Glaucoma patients as a group tend to be somewhat

apprehensive; many of them follow their tensions as religiously as some patients with arterial hypertension. These patients are most grateful for the interest shown in them and for the fact that some form of therapy is now available to control their tension. This is especially so in those who by some misfortune have lost the vision in one eye following one or more surgical procedures.

It is not my purpose to discuss the pros and cons of the medical versus the surgical treatment of glaucoma. I personally subscribe to the school of thought advocating early operation. However, every ophthalmologist has one or more patients for whom, for some reason or other, he would gladly defer surgery if the tension could be satisfactorily controlled by medical means.

This study, I believe, has shown that D.F.P. can be used with impunity on clinic patients, provided the physician prescribing the drug is aware of its advantages and disadvantages. The initial drop in tension is most gratifying, this is frequently precipitous. It is probably due to the fact that the glaucomatous eye is sensitive to acetylcholine.⁴ Since D.F.P. inhibits the cholinesterase, the acetylcholine in the eye is allowed to become effective. After the tension has been reduced, the sensitivity to acetylcholine is gradually lost. This probably explains the gradual rise in tension after the first 48 hours of therapy, when the more stable effect of D.F.P. is apparent.

In my opinion it is unwise to keep the tension too low in an eye that has been maintaining an elevated tension. If the tension was below 20 mm. Hg (Schiotz) when the patients were seen for the second time, they were instructed to reduce the frequency of the instillation of the drops. If the patient's glaucoma is amenable to one to two weeks of therapy one can usually determine whether the drops

are required once or twice a day or once or twice a week.

Leopold and Comroe² have pointed out that the effect of D.F.P. is much shorter in the glaucomatous eye than in the normal eye. They attribute this to some fundamental disturbance in the acetylcholine-cholinesterase balance in the eye. A few of the cases in this series which have been reported as uncontrolled with D.F.P. have subsequently been controlled when a drop of 20-percent mecholyl was instilled in conjunction with the D.F.P.

Although three strengths of D.F.P. were initially used in this study, I believe that the most satisfactory strength is 0.1 percent. This may, on occasion, have to be reduced for the susceptible patient. Increasing the strength of the solution is seldom of benefit. Of the 42 patients who were controlled, only one is using 0.2-percent D.F.P. The stronger solution has been tried without success in the therapy of many in the uncontrolled group.

As is the case when other miotics are used, there can be marked miosis and still no significant decrease in tension. In attempting to evaluate the reasons for success or failure of this drug the degree of miosis was usually noted. In eyes with an intact iris, except in a few of the cases with iris atrophy, the miosis was usually extreme. The degree of miosis was of no prognostic value as to whether the drug would be successful or not. Eyes that had undergone complete iridectomy often responded to D.F.P. therapy without showing any significant miosis.

This drug seems to be equally effective in reducing the tension in the white and in the colored race. From the data available the frequency of medication required to control the glaucoma was the same in both groups.

The limited experience gained by the

use of D.F.P. in this series of patients has uncovered several facts which would appear to be of value in guiding those who may be using it for the first time. This drug is not a cure-all for glaucoma. It may initially cause a fall in tension; then, after a period of several weeks, the tension may gradually rise, and the glaucoma can no longer be considered as controlled. The drug may have little or no effect on the tension. These are characteristics common to all miotics. In cases of absolute glaucoma, the percentage of successes is much lower than that of the failures; this is to be expected, however, and the drug should not be condemned because it is not effective in such cases.

If the tension does not fall or if it rises 60 minutes after the initial drop, the patient should be carefully watched. If, after a 48-hour interval, the tension has not shown an appreciable fall, some other type of therapy should be instituted, provided one is satisfied that the patient is using the miotic frequently enough and that a supplemental miotic is not indicated. It must also be realized that in certain cases D.F.P. may hasten rather than retard the need for surgical intervention. The arteriolar vasodilation and/or ciliary spasm caused by the drug may swing the pendulum in the wrong direction.

The advantages of the drug, however, are believed sufficient to warrant further clinical studies. D.F.P. is by far the most potent and persistent of the newer miotics. In this series of patients there have been no symptoms of systemic reaction or of local irritation.

It is to be hoped that this new drug will be given additional clinical trial. Many ophthalmologists receive every new miotic with great enthusiasm and try it out on those of their patients who have been uncontrolled with every known form of medical and surgical therapy. When the drug does not work it is soon dis-

regarded and frequently condemned. The treatment of glaucoma cannot be standardized, and the patient's reaction to various therapeutic procedures must be carefully evaluated. It is fairly well established now that there is some disturbance of the acetylcholine-cholinesterase balance in glaucoma. It may be that some patients require a drug which inhibits the cholinesterase as well as one that supplies acetylcholine or its counterpart. One should then be prepared to treat the patients on a sound pharmacologic basis rather than empirically.

SUMMARY

1. In a series of 82 patients representing 122 glaucomatous eyes that were uncontrolled by previous miotic therapy, D.F.P. successfully controlled 57.4 percent of the eyes.

2. D.F.P. has been shown to have the following advantages: (a) It is more powerful than any other known miotic; (b) its action is prolonged, many patients requiring seven or less drops a week to keep the tension controlled; (c) it does not cause a local irritative reaction; (d) it would appear to be especially effective in aphakic glaucoma.

3. The disadvantages in using D.F.P. are: (a) The marked discomfort it may produce during the first few days of therapy; (b) the blurring of vision caused by ciliary spasm; (c) the occasional rise in tension that is believed to result from the arteriolar dilatation and effect on the ciliary body caused by the drug.

4. One cannot prognosticate which cases will respond to therapy and which will not. If the tension has not dropped within 48 hours recourse should be had to other measures.

5. D.F.P. must be used judiciously, and correct dosage determined for every patient.

The author is indebted to Drs. Leopold and Comroe of the University of Pennsylvania for supplying the D.F.P. used in this study and to the Attending Sur-

geons of the Wills Hospital for the clinical material.

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INDICATIONS AND CONTRAINDICATIONS FOR KERATOPLASTY AND KERATECTOMIES*

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The surgical procedures used for the treatment of corneal opacities are keratoplasty and keratectomies. Whenever possible, keratoplasty is to be preferred, because the visual acuity obtained with this type of operation is considerably better than that which can be obtained with keratectomies.

With keratoplasty, when the transplant remains completely transparent it is not rare to obtain vision of 20/20 or better, whereas with keratectomies there is always a certain amount of irregular astigmatism and varying degrees of haziness with which vision is rarely improved to beyond 20/100. This presentation is based upon the study of more than 600 keratoplasties and over 100 keratectomies performed at the Institute of Ophthalmology, Columbia Presbyterian Medical Center.

Inflammation contraindicates kerato-

plasty and keratectomies. Whether the inflammation is due to disease (infection, specific lesions, or conditions caused by viruses) or follows trauma, the operation should be postponed until all signs of inflammation have subsided and the eye has remained quiet for at least six months.

In cases of burns caused by chemicals, flame, and molten metals, it is advisable to wait about a year until cicatrization has been completed and photophobia, blepharospasm, and lacrimation have disappeared. Then, when the eye is quiet, the sequela of the injury may be treated either by keratoplasty or keratectomies.

Glaucoma contraindicates these operations. In glaucomatous eyes with corneal opacities, where improvement of vision may be expected by keratoplasty or keratectomies, the glaucomatous state has to be treated first by appropriate operations. When an operation for the control of glaucoma is performed as a preliminary to a keratoplasty, it is advisable to make a very large iridectomy. This procedure will leave the eye in a more favorable condition for the keratoplasty with less danger of

*From the Institute of Ophthalmology, Columbia Presbyterian Medical Center. Read at the eighty-first annual meeting of the American Ophthalmological Society, at Hot Springs, Virginia, November, 1945.

anterior synechia and recurrence of glaucoma. These complications often lead to nebulosity or opacification of the graft.

In regard to prognosis after keratoplasty and keratectomies, patients may be divided into three main groups:

1. These are very favorable cases for keratoplasty in which a high percentage of clear grafts and considerable improve-

thus defeating the purpose of the operation (fig. 2).

(c) Interstitial keratitis, when the opacity is not too dense and extensive and the transplant will remain in contact with fairly healthy corneal tissue. To prevent a recurrence of the interstitial keratitis and subsequent nebulosity or opacification of the graft, the infection responsible for the

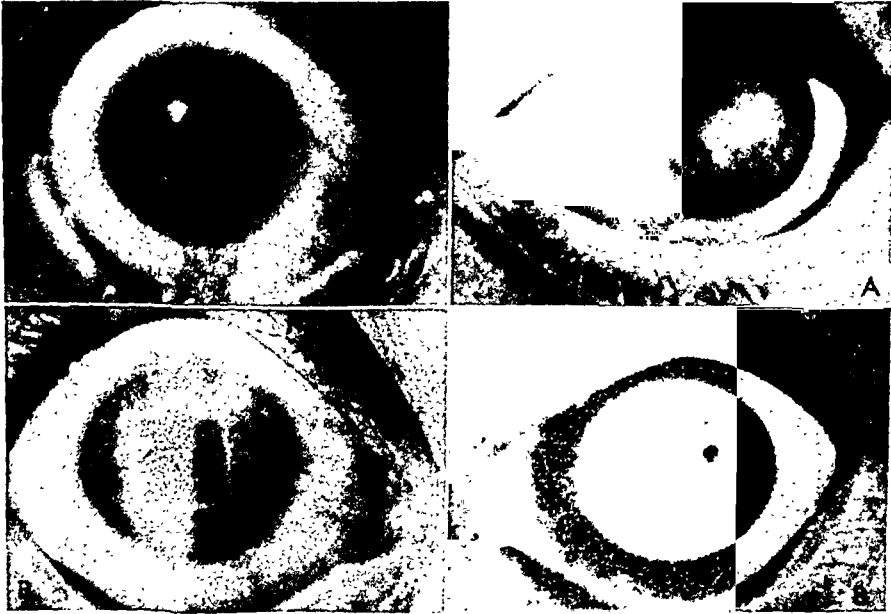


Fig. 1 (Castroviejo). Eyes with central corneal opacities before (A) and after (B) keratoplasty.

ment of vision may be expected, with final vision averaging better than 20/50 and not infrequently 20/20 or better. They occur in the following ocular involvements:

(a) Central corneal opacities where the transplant will remain surrounded by healthy corneal tissue (fig. 1).

(b) Keratoconus, when vision cannot be improved by regular or contact lenses or when the contact lenses are not tolerated. In these cases the transplant has to be large enough to include the conus, otherwise the transplant has a tendency to heal unevenly around the edges and in some instances may protrude, causing pronounced astigmatism or myopia and

keratitis must be cleared or at least treatment of the infection well advanced before the keratoplasty is performed (fig. 3).

2. These cases are less favorable for keratoplasty but still likely to give a high percentage of transparent grafts and considerable improvement of vision. They comprise such involvements as:

(a) Corneal dystrophies (the Fleischer, Haab-Dimmer, Groenow, and Salzmann types) (fig. 4).

(b) Superficial opacities which extend over the whole area of the cornea but in which the epithelium has a healthy appearance, there is not superficial vascularization, and it can be seen either by

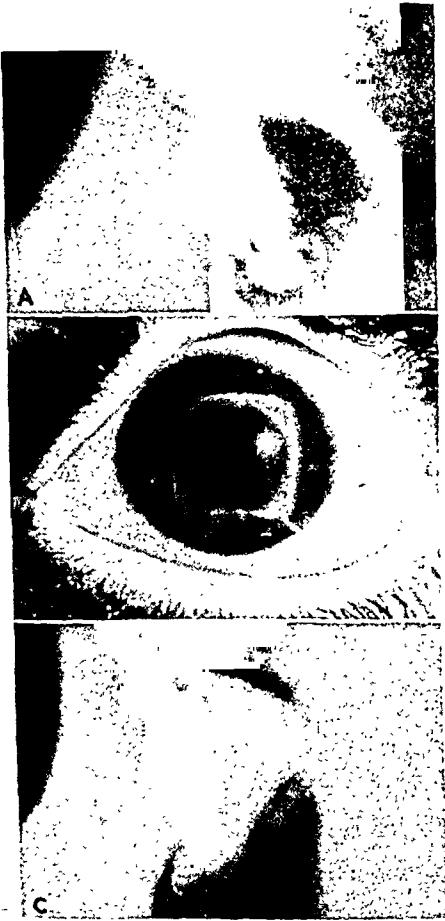


Fig. 2 (Castroviejo). Keratoconus before (A) and after (B and C) keratoplasty.

observation with the naked eye, oblique illumination, or examination with the slit-lamp that most of the stroma and the inner layers of the cornea are normal (fig. 5).

(c) Tear-gas burns, when there is no pannus-type superficial vascularization;



Fig. 3 (Castroviejo). The result of keratoplasty in a case of interstitial keratitis.



Fig. 4 (Castroviejo). Corneal dystrophy before (A) and after (B) keratoplasty.

the destruction of the cornea includes only a limited area of the superficial layers, and enough healthy cornea remains underneath to nourish the graft (fig. 6).



Fig. 5 (Castroviejo). Extensive superficial corneal opacity before (A) and after (B) keratoplasty.

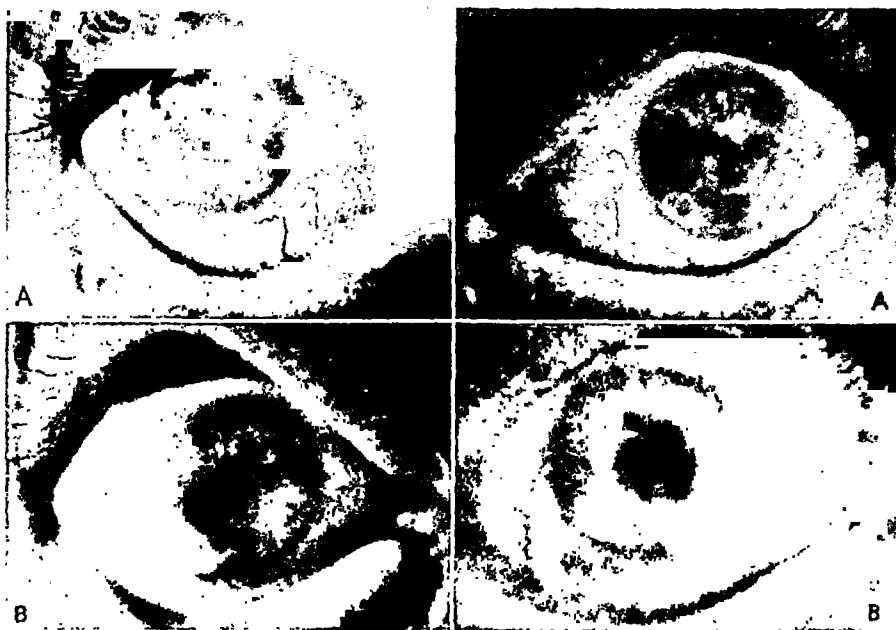


Fig. 6 (Castroviejo). Tear-gas burns of cornea before (A) and after (B) keratoplasty.

(d) Adherent leukomas. Keratoplasty should be preceded by an iridectomy to free the iris from the corneal scar.

(e) Descemetocelles (following corneal ulcers or surgical procedure) in or near the pupillary area, when the whole opacity

including the descemetocelle may be substituted by a corneal graft (fig. 7).

(f) Interstitial keratitis with more extensive and denser opacity than that already mentioned in (c) under group 1, but still with sufficient permeability in the corneal stroma, giving reason to suppose



Fig. 7 (Castroviejo). Corneal opacity with descemetocelle before (A) and after (B) keratoplasty.



Fig. 8 (Castroviejo). Extensive and dense interstitial keratitis before (A) and after (B) keratoplasty.

that the transplant will remain more transparent than the original opacity (fig. 8).

3. These cases are unfavorable for keratoplasty. They occur in such involvements as:

(a) Corneal scars which, including the pupillary area, extend to the limbus. In

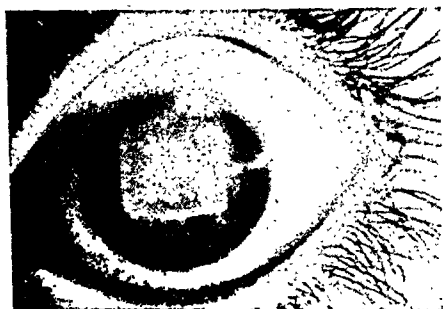


Fig. 9 (Castroviejo). Nebulous transplant in an example of corneal scar extending to the limbus.

these cases the transplant is likely to become vascularized and subsequently nebulous or opaque. In these cases keratoplasty may be performed with guarded prognosis. It should be preceded by a preliminary large iridectomy correspond-

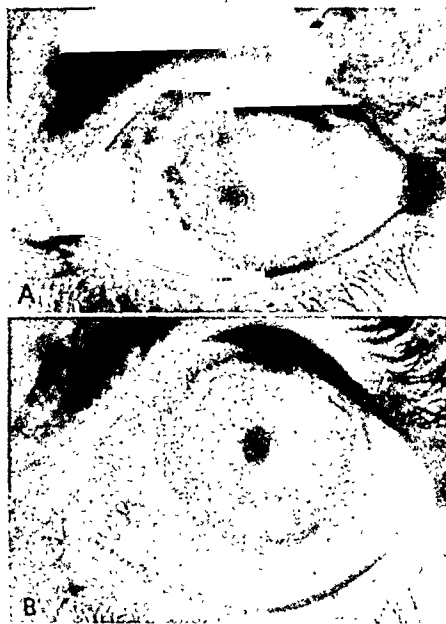


Fig. 10 (Castroviejo). Extensive corneal leukoma before (A) and after (B) partial superficial keratectomy.

ing to the corneal opacity. If the transplant should become nebulous the eye is generally left in a more favorable condition to undergo a second keratoplasty in the pupillary area because the cornea is usually left with a haziness which is not as dense as the original leukoma (fig. 9).



Fig. 11 (Castroviejo). Dystrophia adiposa. Before keratoplasty (A). One month after keratoplasty (B). (This graft became opaque several weeks later.) Stages in opacification of the graft after keratoplasty (C and D).

(b) Extensive leukomas in which the transplant will be surrounded in more than one half of its circumference by dense scar tissue. In these cases a partial superficial keratectomy which removes as much as possible of the thickness of the scar may improve vision. If, after kera-



Fig. 12 (Castroviejo). Corneal opacity after dynamite explosion. Before operation (A). After preliminary partial superficial keratectomy (B). After subsequent keratoplasty (C).

tectomy, vision has not improved as much as desired, the eye is left in a more favorable condition to undergo a keratoplasty (fig. 10).

(c) Band-shaped opacity. In these cases the transplant generally becomes invaded by the opacity, and one should preferably perform a partial superficial kera-

tectomy, excising the affected area of the cornea.

(d) Dystrophia adiposa. The transplant is invariably invaded by the dystrophy and becomes opaque (fig. 11). In these cases it is preferable to perform a partial superficial keratectomy as extensive as may be necessary to excise the whole affected area, in surface and in depth preserving as much as possible of



Fig. 13 (Castroviejo). Opaque transplants after keratoplasty in two examples of dense vascularized leukomas of the cornea.

the normal peripheral corneal epithelium, which will serve to epithelize the dissected corneal area.

(e) Deep corneal burns due to tear gas, whether the eye is quiet or suffers from photophobia, blepharospasm, and lacrimation. In these cases it is advisable to carry out a partial superficial keratectomy, with the removal of all of the superficial affected area and to the depth necessary to reach clear corneal tissue without perforation. By means of this procedure enough vision may be obtained to make further surgery unnecessary, but if the improvement of vision obtained is not

sufficient, the eye is generally left without photophobia, blepharospasm, and lacrimation and remains in a more favorable condition to undergo a keratoplasty.

(f) Extensive corneal opacities caused by explosions which leave the cornea with a tattooed appearance. A partial superficial keratectomy is likely to improve vision sufficiently; if not, a keratoplasty may be performed afterward with better chance of success (fig. 12).

(g) Corneal opacities in aphakic eyes, particularly after intracapsular cataract extraction. These cases are unfavorable because the iris, capsule of the lens, or vitreous is likely to become incarcerated in the corneal incision. This complication is very likely to render the transplant quite nebulous or opaque.

(h) Extensive corneal opacities, with superficial vascularization of the pannus type, generally caused by burns (chemical, flame, or molten metals), do not lend themselves well to keratoplasty, and the transplant invariably becomes opaque (fig. 13). These cases are better treated by means of superficial keratectomies. If

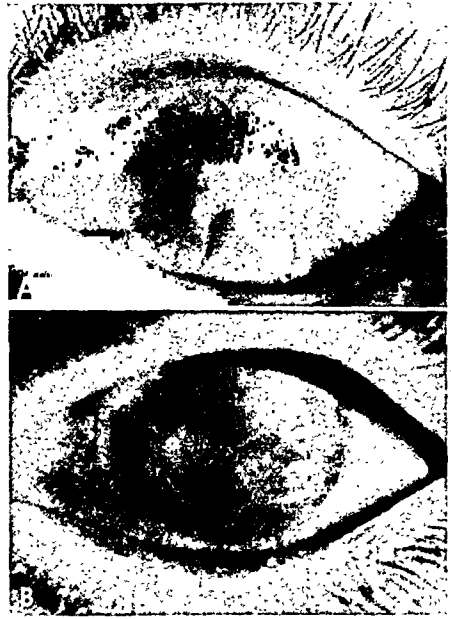


Fig. 14 (Castroviejo). Dense vascularized leukoma before (A) and after (B) total superficial keratectomy.

the opacity does not extend over the whole area of the cornea, the healthy cornea should be preserved, and only the superficial layers of the cornea be dissected, including the opacity with the blood vessels. The operation must be followed by X-ray treatments to prevent the

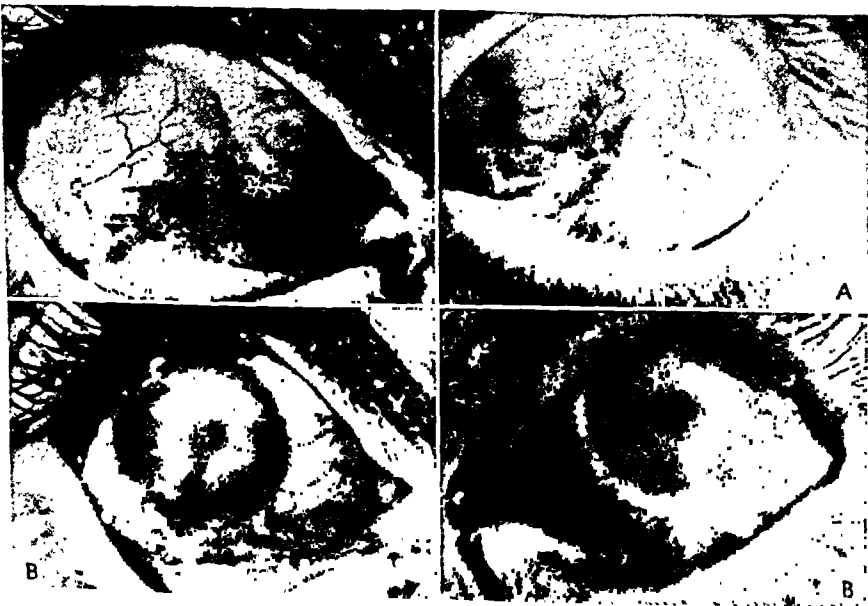


Fig. 15 (Castroviejo). Dense vascularized leukoma and symblepharon before (A) and after (B) total superficial keratectomy with corneo-conjunctival plastic operation.

recurrence of corneal vascularization. If the opacity extends over the whole corneal area, a total superficial keratectomy should be performed followed by irradiation to prevent the recurrence of corneal



Fig. 16 (Castroviejo). Example of cases suited to corneal surgery. Pemphigus (A). Corneal opacity with calcareous degeneration in a glaucomatous eye (B).

vascularization (fig. 14). If, in addition to an opacity of the cornea, there is a symblepharon, a total superficial keratectomy for visual purposes must be combined with corneo-conjunctival plastic (fig. 15), or corneo-conjunctival plastic and buccal-mucosa implant for the correction of the symblepharon.

Fuchs's epithelial dystrophy, extensive corneal opacities with calcareous degeneration, corneal opacities caused by pemphigus, and corneal opacities with extensive anterior synechiae are not improved by keratoplasty or keratectomies (fig. 16).

Eyes with corneal opacities of many years' standing, particularly when there is a pronounced nystagmus, are not suitable for keratoplasty for visual purposes

because these eyes have a high degree of amblyopia. Although the transplant may remain transparent, vision does not improve (fig. 17).

Keratoplasty is contraindicated even in the presence of a favorable eye in patients who during the examination are very uncoöperative, the so-called high-strung type. In these it is reasonable to as-



Fig. 17 (Castroviejo). Clear corneal transplant in a case of corneal scar with pronounced nystagmus.

sume that, on account of poor coöperation, the postoperative recovery will be stormy, with great danger of severe complications such as extensive anterior synechiae and subsequent secondary glaucoma or prolapse of the transplant leading to loss of the eye.

COMMENT

Keratoplasty and keratectomies are no longer surgical procedures of uncertain results. Sufficient numbers of cases have already been studied to determine fairly accurately in which cases this type of surgery will be helpful. Further study of patients operated upon by keratoplasty or keratectomies will give additional data in regard to the feasibility of employing these techniques in a greater variety of corneal affections, particularly with reference to those which at present are considered unfavorable cases.

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DISCUSSION

DR. WILLIAM H. CRISP (Denver): I should be obliged if Dr. Castroviejo would tell us something about the very extreme cases of keratoconus, rarely seen, in which there is great bulging of the cornea and some cloudiness of the apex of the extreme cone.

I should also be obliged if Dr. Castroviejo would tell us a little more as to whether one may expect any gain from X-ray treatment of general vascularity from a tear-gas burn many years after the accident occurred.

DR. F. H. VERHOEFF (Boston): I wish to ask Dr. Castroviejo his opinion as to the possibility of recurrence of corneal dystrophy in a graft, and whether in this respect there is any difference in the various types of dystrophy. I know such recurrence has been recorded and I should like to know whether he thinks its likelihood is great enough to contraindicate keratoplasty.

DR. RAMÓN CASTROVIEJO (closing): Dr. Crisp has asked if a very extensive keratoconus is suitable for keratoplasty. If the keratoconus is very extensive but one feels that the whole conus can be replaced by a transplant $6\frac{1}{2}$ or 7 mm. in size, the eye is suitable for keratoplasty. If the conus is so large that in order to replace the whole conus, a transplant larger than 7 mm. will be required, the operation is likely to be followed by severe complications such as extensive synechiae leading to secondary glaucoma. In such a case it is advisable to flatten the conus by treating approximately 6 mm. of the center of the conus with a fulgurating current applied with a fine electrolysis needle. After the treatment, the eye has to be bandaged with a pressure dressing and the pressure dressing

continued until cicatrization has been completed. This treatment causes corneal opacity of the treated area but the eye is rendered more favorable for keratoplasty when the corneal curvature has been brought within approximately normal limits.

In regard to extensive vascularization of the cornea treated by irradiation, my experience has shown that once the blood vessels have already formed, treatment by X-ray or radium is of no value. Irradiation has to be given before the blood vessels have formed. After keratectomies, X-ray treatment is instituted on the same day or on the day following the operation, when the capillaries are beginning to form and are easily obliterated by irradiation. In this way, vascularization of the cornea is prevented.

To Dr. Verhoeff's remark of the likelihood of the transplant's becoming involved by the cornea of the host affected with a dystrophy, it can be said that in some instances, the dystrophy of the host invariably invades the transplant; for example, in cases of Fuchs's dystrophy and dystrophia adiposa. In other dystrophies, the transplant is likely to remain transparent. Because of the uncertainty in regard to the final transparency of the transplant in cases of dystrophies, these have not been classified in the most favorable group but in the less favorable. However, the transplant is likely to remain more transparent or at least clearer than was the original opacity.

DR. VERHOEFF: But they undergo a recurrence of the same type of opacity?

DR. CASTROVIEJO: Yes, in some cases the transplant is partially or totally involved by the same dystrophy of the host.

ARSENICAL EYE BURNS*

A CASE REPORT

GEORGE I. UHDE, M.D.†

Portland, Oregon

Lewisite is an arsenical compound, developed toward the end of World War I but never actually used in combat. The lesions are much more painful than those caused by mustard gas. Immediately on exposure to lewisite, there is severe eye pain, blepharospasm, and lacrimation resulting in instant warning to any potential victim. For that reason, there did not occur so many nor so severe burns as on exposure to mustard gas.

PHYSIOLOGIC EFFECTS ON EXPOSURE TO THE VAPOR

The vapor of the pure substance is not lacrimatory but is very irritant to the upper respiratory tract, thus causing a reflex flow of tears. Lewisite vapor, surprisingly enough, does not cause corneal damage, at least in some animals, until large concentrations are reached. Eight patients out of 1,097, or 0.7 percent of the eye, ear, nose, and throat patients, were treated for lewisite-vapor burns at Edgewood Arsenal during the 17 months preceding March 1, 1943. These burns were all very mild.

PHYSIOLOGIC EFFECTS OF A SPLASH BURN

The site of contamination of a rabbit's cornea with a lewisite droplet becomes im-

mediately opaque. The lewisite appears to soak into the cornea almost instantaneously. There is obvious severe pain; the animals frequently squeal. Lid spasm is very severe for 15 to 30 seconds. The pupil may constrict in about two minutes. The corneal epithelium, which is so hazy that it is difficult to make out the iris, begins to loosen in about one to two hours.



Fig. 1 (Uhde). Rabbit's eye showing severe chemosis one hour after contamination with 0.0002 c.c. of lewisite.

The denuded corneal surface stains with fluorescein. The conjunctiva is severely edematous and contains numerous small hemorrhages (fig. 1). Edema extends into the substantia propria. The whole thickness of the cornea becomes edematous in about seven hours. At 24 hours, there is an iritis with strands of exudate in the anterior chamber. The limbus epithelium with its pigment begins to slide over the denuded corneal surface. Vessels commence to invade the cornea from all parts of the limbus on the sixth to the eighth

* Presented as part of a lecture to classes attending the Medical Field Service School, American School Center, European Theater Operations, United States Army.

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day. The eye usually perforates in two to five weeks (fig. 2).

REPORT OF CASE

A white man, aged 26 years, was splashed in the right eye with a mixture of arsenic trichloride with small quantities of mercuric chloride, hydrochloric acid, and lewisite. His eye was very painful. He jumped immediately under a shower and his eye was thoroughly irrigated for about 12 minutes. BAL solution or ointment was not available. The patient was hospitalized altogether for about 10 weeks. There is now a dense leukoma and pannus formation over about half the cornea with diffuse nebular haziness of the remaining corneal tissue (fig. 3). There are dense anterior synechiae between the scar and the adjacent iris. The visual acuity is light perception and projection only, whereas the visual acuity in the opposite eye is 20/30.

Treatment. Although most liquid chemicals can be mechanically removed from the eye by immediate irrigation with water, lewisite is one of the exceptions. Lewisite apparently enters into combination with tissue cells so rapidly that it can be removed or destroyed only

by chemical neutralization. Fortunately, the latter can be accomplished by means of an antidote developed by the British and called BAL (British Anti-Lewisite).

BAL should be used as soon as possi-



Fig. 3 (Uhde). Human eye splashed with a mixture of arsenic trichloride and small quantities of mercuric chloride, hydrochloric acid, and lewisite, showing leukoma and pannus formation.

ble after injury. If BAL is used within two minutes after contamination, a short period of disability with complete cure can be expected. The period of disability will be increased but complete cure may result if BAL is used within the first five minutes (fig. 4). The period of disability and the final damage increases markedly with any further delay between contamination and treatment (figs. 4, 5, and 6). For instance, in a series of experiments carried out by the author and Lt. Comdr. R. Leishman (R.N.V.R.) with one tube of BAL ointment, treatment at the end of two minutes neutralized the destructive effect of lewisite so that within 10 days, 100 percent of the eyes were normal; with treatment at five minutes, 77 percent were cured; whereas, at 30 minutes the cures dropped to 33 percent. These latter figures make it quite evident that treat-



Fig. 2 (Uhde). Rabbit's eye contaminated with 0.0002 c.c. of lewisite, untreated, appearance 22 days later (eye perforated on the 14th day).

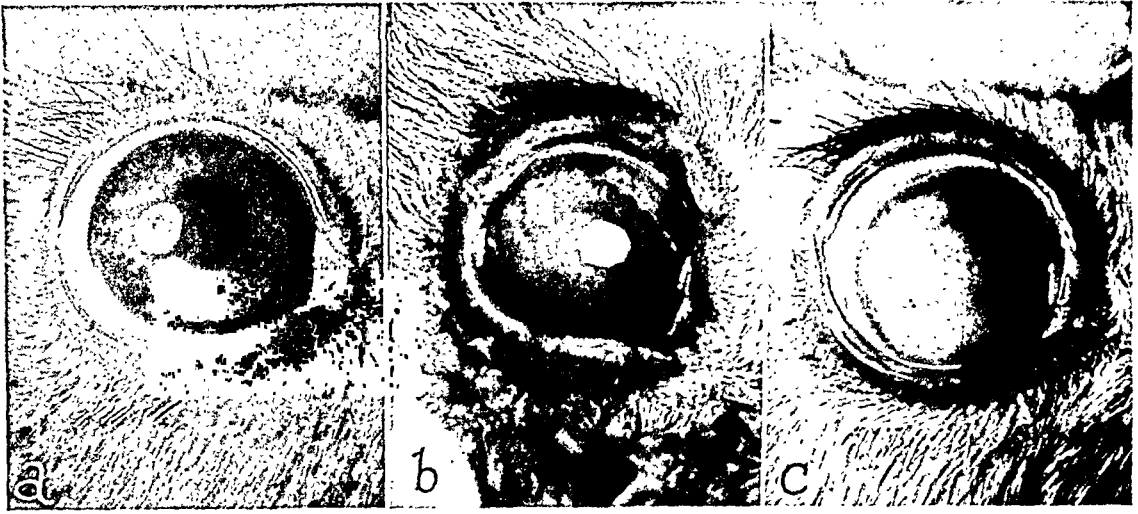


Fig. 4 (Uhde). Rabbits' eyes showing that the period of disability is increased (and the final damage) as the interval between contamination and treatment is prolonged: a, Treated with BAL ointment 5 minutes after contamination with a destructive dose of lewisite, appearance on the 7th day, almost complete recovery. b, Treated with BAL ointment 15 minutes after contamination with a destructive dose of lewisite, appearance on the 7th day, keratitis. c, Treated with BAL ointment 20 minutes after contamination with a destructive dose of lewisite, appearance on the 7th day, severe keratitis.

ment may be worthwhile in an occasional eye even after a fairly long interval. Therefore an injured eye should be treated even if as much as an hour has elapsed after contamination.

BAL ointment replaced the original solution because during an emergency most of the solution is spilled. It is much easier for a soldier to instill an ointment

than a solution into his eye, especially if he is in a prone position.

Instructions for the use of BAL issued to each soldier in the European Theater Operations were as follows: In any painful splash of the eye, break off the tip of the BAL tube, place BAL on an index finger, massage the ointment firmly between the lid margins by pulling down



Fig. 5 (Uhde). Rabbit's eye contaminated with 0.0002 c.c. of lewisite, treated 10 minutes later with BAL ointment, appearance 22 days later. Fig. 6, Each eye of rhesus monkey contaminated with 0.0002 c.c. of lewisite, right eye treated 15 minutes later with BAL solution, left eye untreated, appearance at 3 months.

the lower lid so that the ointment goes into the eye. Then place the remaining ointment into the eye, close the lids, and rub the ointment firmly into the eye and lids.

An important problem confronting officers responsible for the treatment and training of personnel was: How is the soldier going to know whether to irrigate or use BAL ointment? The ideal solution would be to have a single ointment equally effective against both mustard and lewisite. Unfortunately, this is not possible at present.

The soldier was instructed to irrigate his eye immediately after any painless, "watery" splash. Immediate irrigation is by far the most effective treatment against a mustard splash.

In any painful liquid contamination of his eye, the soldier was instructed to use BAL ointment.

What about the treatment of a 50/50 mixture of lewisite and mustard gas, which is also painful? It was found experimentally that the best results in such combinations were obtained by the instillation of BAL ointment. The most logical procedure would seem to indicate immediate irrigation to remove the mustard gas and then the instillation of BAL to counteract the lewisite. However, numerous experiments carried out refuted this belief. The best results were obtained by the simple instillation of BAL. There are two possible explanations of this result: (a) BAL is very irritating and produces severe tearing, which may act nearly but not quite so effectively as sim-

ple irrigation in the removal of the mustard; and (b) 0.0002 c.c. of lewisite destroys a rabbit's eye, whereas it usually takes three or four times as much mustard to result in similar destruction. In a 50/50 mixture, therefore, the lewisite is doing more than its proportional share of damage. In other words, the amount of mustard present in such a mixed droplet will usually not, by itself, produce any serious effect in any eye. Moreover, Dunphy has shown that BAL ointment alone, if used within one minute, will save a majority of mustard-contaminated eyes, probably, again, as a result of the irrigating effect of the flow of tears caused by the irritant properties of BAL.

What about a painful liquid-tear-gas contamination of the eye? Prof. Ida Mann has shown that BAL ointment does not increase the severity of such a lesion although Bal is very painful in a normal eye.

When the soldier is in doubt he should instill BAL ointment.

To reiterate, the soldier in the European Theater Operations was instructed to irrigate immediately in any painless, "watery" splash of his eye and to use eye ointment (BAL) in any painful splash or when in doubt.

SUMMARY

The clinical features and treatment of arsenical eye burns are discussed and illustrated with photographs and a case report.

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A DEVICE FOR GROUP DEMONSTRATION OF ASTIGMATISM TESTS*

WILLIAM H. CRISP
Denver, Colorado

There is wide variation in the capacity of different individuals for visualization of geometric and other mathematical processes. Even in the most mathematically inclined, the power of visualization is greatly improved by direct experience, or at least by careful study of pictorial illustrations. Any one of these contacts demands thought as well as vision, but mere verbal description reaches the brain a good deal more slowly and vaguely than does pictorial demonstration or solid reality.

Many refractionists have a relatively feeble notion of what goes on in the patient's brain during tests for astigmatism. The nature of tests with astigmatic dials is easier to apprehend than that of tests with the cross cylinders. It was to bring the latter group of tests more effectively to the understanding of workers in refraction that I presented my photographic picturization of the subject to the Washington International Congress of Ophthalmology in 1921.

Several years ago it occurred to me that the new projectors for use with 35-mm. film, with their relatively small objective lenses, should be capable of providing an improved method for demonstrating astigmatic tests, especially those tests in which letters and astigmatic dials are used in combination with cross cylinders. What I had particularly in mind was the placing of minute photographic reproductions of the various charts in the usual position for projection—that is, between the light condenser and the objective lens—and then rotating or “flopping”

the cross cylinder, not behind the objective lens of the projector but immediately in front of it—between it and the screen.

The convenient performance of such manipulations demands the setting up of a small apparatus beyond the objective lens, and it was only after much delay that I finally proceeded to work out the construction of a suitable mechanism. This consists of a carrier in which may be inserted a simple cylinder at a selected axis and another cylinder which perfectly or in various degrees of imperfection corrects the astigmatism created by the first cylinder, and then in front of these simple cylindrical lenses a fixed, semicircular metal arm on which can be supported a cross cylinder capable of the same manipulations as are employed in testing a patient's eyes.

The first, posterior, simple cylinder is used to make the projection lantern astigmatic. Take, for example, a plus 0.50D. cylinder at axis 90°, which will render the apparatus astigmatic in the horizontal meridian. The anterior simple cylinder may then be primarily of either inadequate, adequate, or excessive strength and may be placed at any incorrect or at a finally correct axis. The cross cylinder on the metal carrier is flopped into the usual two positions in testing for amount of cylinder, or the usual two positions in testing for axis of cylinder. The primary astigmatic effect upon test letters or upon astigmatic dials will be first projected on the screen, and the effect of partial or of exact correction or of overcorrection can be shown, either with the anterior simple cylinder or with this in combination with the manipulations of the cross cyl-

* Read at the eighty-first annual meeting of the American Ophthalmological Society at Hot Springs, Virginia, November, 1945.

inder. Or the cross-cylinder test for correct axis may be carried through all the manipulations used upon the patient, varying the position of the more or less correcting simple cylinder and displaying, in accordance with the rules of the game, the effect of the changing positions of the cross cylinder.

Apart from the irregularities of the human eye, certain optical complications of the use of the projection lenses interfere moderately, but only moderately, with the complete accuracy of the scheme. However, its effect is close enough to accuracy to allow of furnishing an excellent illustration of what is seen by the patient in the various tests. It is my thought that, in institutions where the formal teaching of refraction is undertaken, much might be gained for graphic presentation of the subject to groups of students. My own appa-

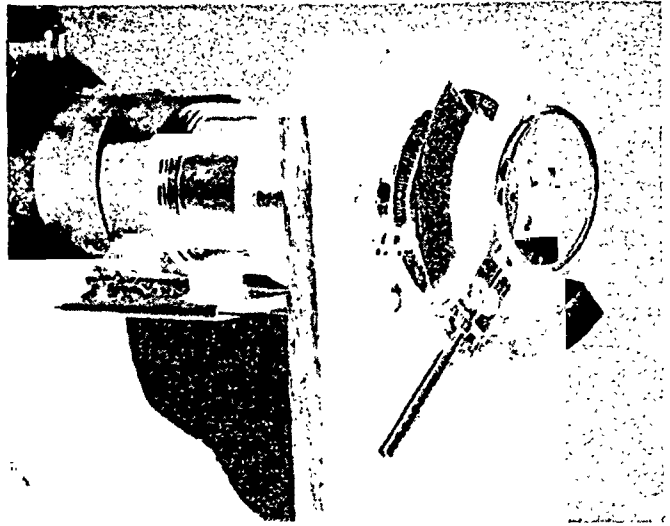


Fig. 1 (Crisp.). A device for group demonstration of astigmatism tests.

ratus is crude but sufficiently effective to serve the purpose.

(The author personally demonstrated upon the screen, using an S. V. E. 35-mm. projector, the various manipulations referred to in his paper.)

530 Metropolitan Building (2)

DISCUSSION

DR. JOHN GREEN (St. Louis): The present wide popularity and almost universal use of the cross cylinder by American ophthalmologists is due, in very large measure, to the enthusiastic advocacy by Dr. Crisp of the unique value of the method in insuring high accuracy in the subjective measurement of the refraction. His careful descriptions of the technique, supplemented by drawings and photographs, have made the practical steps in the process completely understandable.

Dr. Crisp states that "many refractionists have a relatively feeble notion of what goes on in a patient's brain during tests for astigmatism." I am convinced, too, that ignorance of what goes on in the patient's eye during manipulations with the cross cylinder is fairly widespread,

and this despite the clarification of the subject by both Jackson and Crisp.

I am not entirely in agreement with the author's statement that "the nature of the tests with astigmatic dials is easier to apprehend than that of tests with the cross cylinder." This view may be valid when dealing with keen and highly intelligent patients. Given a patient with a not too bright mentality (a little above the level of Mortimer Snerd but below that of Charlie McCarthy), it has seemed to me that I have to devote an unconscionable amount of time in attempting to get consistent answers to the query "which are the most distinct lines in the chart?"

I use a modification of Lancaster's chart in the form of a fan, with the lines at 10° intervals (21 radii in all), and I have

my nurse at the first signal from the patient place a black pointer at the outer termini of the radii primarily selected. After a rest interval (with the patient in semi-darkness and suitably fogged) reëxamination will sometimes yield answers inconsistent with those given primarily.

I have found it useful (though time consuming) to dislodge the patient from his chair and to walk him up to within 5 ft. of the chart while I deliver a little lecture on the beauties of the astigmatic chart when all the lines are uniform in appearance.

No one can deny the beauty of Dr. Crisp's demonstration, which he has devised for group instruction. Might it not also be used as a preliminary exercise for patients about to undergo the test? The demonstration could be conducted by the technician, so that the patient thus instructed would be reasonably familiar with the changes wrought in test letters and astigmatic charts when seated at the test range.

I hope Dr. Crisp may develop his device to illustrate pictorially the vagaries and aberrations of the accommodations, disregard of which is all too common in the hurried and mass refractions of busy offices and busier clinics.

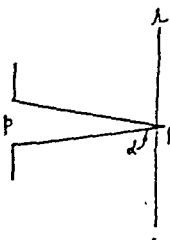
DR. WALTER B. LANCASTER (Boston): I think the method of projection is very valuable, and I used the method of projection before this Society some years ago in demonstrating astigmatism with a projector. What I wish to call attention to today is the fact that most of the methods used are qualitative and not quantitative. I mean by that, the aberration produced on these letters by an 0.25D. cylinder is not quantitatively comparable to that produced in the human eye. Many years ago Hess published some photographs of pages of print as they appeared to the camera made astigmatic with a cylinder

lens. I do not remember what strength cylinder he used, say 0.5D., and the print was almost illegible. We know very well that 0.5D. before the normal human eye does not produce any such illegibility. I think Dr. Verhoeff also reproduced some print with a camera made astigmatic but without making quantitative comparisons.

I showed before this Society, when Dr. Prangen was presenting a paper on the conoid of Sturm, the method of projecting the conoid with a lantern, and showing the amount of astigmatism produced by a small astigmatic lens, 0.25D. In my paper before the Academy in 1915, I went into the question of photographing the test objects with a camera made astigmatic, and I should like to show the results.

In the figure, p is the pupil or aperture; r is the retina = the focus of the emmetropic eye; f is the focus when $-0.25D.$ cylinder is added; d is the diffusion circle (line if the cylinder is used) on the retina. The magnitude of the blur depends on three things: (1) on the size of the pupil; (2) on the ratio the distance from the retina (where the blur circle is) to the focus bears to the distance from the pupil to the focus (this ratio is $df : pf$); and (3) on its effect on the magnification of the image by the lens system—if the system magnifies five times as much it will tolerate five times as large a diffusion circle with comparable blurring effect.

df is the distance in millimeters of the focus behind the retina when the eye is made hypermetropic by a minus lens, in this case $-0.25D.$ cylinder. It is calculated as follows: The focal length of the eye when the focus is on the retina may be taken as 22 mm. = 45.45D. When the $-0.25D.$ cylinder is added this becomes 45.20D. = 22.12 mm. The new focus is therefore -0.12 mm. back of the retina,



$df = 0.12$. The ratio of df to pf is $0.12 : 22.12 = 1 : 184$.

In the case of the camera, the focal length (if a 6D. lens system is used) is 166.7 mm. When $-0.25D.$ is added, this becomes $5.75D. = 173.9$ mm. The value of df is $173.9 - 166.7 = 7.2$; $df : pf = 7.2 : 173.9 = 1 : 24$.

Thus the blur in the eye is $1/84$ of the pupil diameter 4, which equals 0.021 mm. The blur in the camera is $1/24$ of the aperture; if the aperture is 20 mm. the blur equals 0.833 mm. The blur circle (line) is 40 times as large in the camera as in the eye, supposing apertures of 20 for camera and 4 for eye. How much should we allow for magnification of image? The image size for an object at a given distance depends solely on the distance from the nodal point to the retina or film. In the eye it is 17 mm. from nodal point to retina; in the camera it is 167 mm. from nodal point to film. Thus, the camera image is 10 times as large as the eye image. If one wishes the camera to have a blur circle (or line) comparable to the eye, it must reduce its blur to 10 times that of the eye instead of 40 times. This is readily accomplished by reducing the aperture to one fourth its former size of 20 mm. With an aperture of 5 mm. the camera with a 6D. lens system would give images whose blur would be comparable quantitatively to the blur in the eye with an $-0.25D.$ cylinder. By a similar calculation, quantitative results could be obtained with a camera of a different focal length of lens. The same is true of a lantern.

Why not do this when demonstrating to an audience or class so that they may get a true and correct idea of what a .25D. lens produces in the way of blur?

DR. F. H. VERHOEFF (Boston): For illustrating his paper on astigmatic charts, Dr. Lancaster employed an ordinary photographic lens corrected for aberrations.

In spite of the employment of a corrected lens, Dr. Crisp's apparatus is very useful for instructing a group of students who know little about the subject of refraction. It would be a difficult matter to construct an apparatus that would simulate the optical defects of the normal human eye. I have never thought it worth while to attempt to do so. For each individual student has an optical apparatus of his own, his eye, which we may use for teaching purposes. If its refraction is normal, we can make it abnormal as desired by means of spheres and cylinders.

DR. W. H. CRISP (closing): The point that Dr. Lancaster emphasized as to the relatively large aperture in the human eye is an important one. Many of you who do photography are familiar with the F system for indicating the relative size of the lens aperture. Suppose you have a half-inch lens and a $5\frac{1}{2}$ -inch focal length, that is $5\frac{1}{2}$ divided by 0.5, which gives F 11; while in the human eye suppose you have a 4-mm. pupil and a distance back from the diaphragm to the retina of at most 20 mm. Then you have a ratio of 1 to 5, making F 5, quite a large opening. All these demonstrations are rendered somewhat unsatisfactory by the fact that we get a very much greater difference in the camera than in the human eye. In other words, in this respect the human eye is a more beautiful optical apparatus than the camera, although the camera is better in other respects.

I have here a supplemental note with regard to the apparatus. Tried on different lanterns, one becomes conscious of some differences of effect as between different projectors. With a high-class anastigmatic lens, the effect may show less satisfactorily than with a cheaper outfit. The effect on the projection of certain astigmatic dials is at times almost as paradoxical as that of astigmatic dials on some

patients. Used with the letters, however, it demonstrates some of the difficulties which patients experience in answering questions.

Some letters, on account of their shape, are so distorted as to suggest a somewhat different judgment on the part of the patient than other letters, which is in harmony with the fact that, generally speaking, it does not pay to ask the patient to concentrate on a single letter but it is better to have him base his judgment on a survey of a whole line of letters as distorted by the cross cylinder in its two po-

sitions. We are also given an illustration of the fact that the patient can sometimes make a more definite decision if he is looking at the larger letters instead of at the smallest letters he is able to read. We also realize the need for instantaneous reversal of the position of the cross cylinder, without an interval in which the patient can be distracted by the more normal intervening appearance of the letters. The device shows fairly well the frequent emphasis on the vertical parts of letters in one position and on the horizontal parts in the other position.

CULTIVATION OF HUMAN TUMOR IN THE ANTERIOR CHAMBER OF THE GUINEA-PIG'S EYE*

EUGENE M. BLAKE, M.D.
New Haven, Connecticut

The general pathologist and the worker in the field of cancer research are thoroughly familiar with the experiments of Dr. Harry S. N. Greene, professor of pathology at the School of Medicine, Yale University, who has succeeded in the transplantation and growth of embryonic tissue and various mammalian and human tumors into the anterior chamber of laboratory animals. It is doubtful, however, if the clinical ophthalmologist is conversant with this work. So, because of the opportunities this method presents to study numerous problems of interest to the latter, the writer has asked permission to report a few of the outstanding developments of Dr. Greene's work and to present the results of a small problem undertaken under his guidance.

As early as 1882, Fischer¹ transplanted pieces of rib and ensiform process from human embryos into the wattles of hens,

and reported growth of the transplants. Since that time many investigators have attempted, with more or less success, the homologous and heterologous transplantation of different tissues into various parts of experimental animals. After many other approaches to the problem, Greene found that the anterior chamber provided the best site for the study of such transplants, both because of higher percentage of takes and because the growth of the transplant can be watched from day to day with the naked eye and under magnification. The animals used have been rabbits, swine, goats, and guinea pigs. Of these the rabbit, and especially the guinea pig, were found best adapted to this purpose.

Only a few of the interesting developments of this work need be related, but it is desirable to present them because of their intrinsic value and to form the background of the side experiment on the progressive growth of the human tumor tissue in the anterior chamber of the

* Read at the eighty-first annual meeting of the American Ophthalmological Society, Hot Springs, Virginia, November, 1945.

guinea pig, which is the subject of this communication.

Transplantation is performed under local anesthesia, using a few drops of 5-percent solution of cocaine hydrochloride. An incision is made at the limbus above, by thrusting a double-edged knife through this tissue into the anterior chamber. A portion of the aqueous is allowed to escape and a piece of tumor, about 1 mm. in size, is inserted into the chamber by means of a trocar. By gently stroking the cornea this transplant is worked down to the lower angle of the chamber. No sutures are employed, and infection is very rare. An instance of homologous transplantation is that of an adenocarcinoma of the rabbit uterus into the anterior chamber of other rabbits.² In such transfers, 90 percent of the transplants take, and growth is usually evident during the second week. The chamber is usually filled by the 30th day. Regression of the growth occurs in 70 percent of the eyes, but in the remainder growth is progressive, and metastases occur after 6 to 8 months. Heterologous transplantation to guinea pigs, goats, and swine has also been effected, utilizing the same inoculation sites, and the tissue has been carried by serial passage for many generations in the foreign host.

As a rule it is possible to tell if a take has occurred by the second week, but at times as long as 110 days are required before growth becomes evident. Growth is manifested by an increase in the size of the transplant and the development of a pinkish color. Occasionally, the anterior chamber is completely filled by the 15th day, but more often 6 to 7 weeks pass before the transplant attains this size. Rarely is growth extremely slow, but in one instance the tumor had increased to only 2.5 mm. in size after a period of 785 days.

At autopsy the findings are consistent: The growth is seen as a pinkish, semi-

translucent mass. The fast-growing tumors are attached to the iris over only a small area, resembling a polyp, whereas the slow-growing tumors invade a large part of the iris, replacing the stroma. The cornea is occasionally invaded, and the growth may extend into the vitreous. Microscopically, the heterologous transplants are much like those of homologous transplants. The epithelial cells are identical and show the same tendency of arrangement. No lymphocytic infiltrations and scant changes suggestive of a foreign-body reaction are observed. Results similar to these changes are observed on transfer of a variety of other tumors from the rabbit to the guinea pig eyes.

The success obtained by using the anterior chamber as a transplantation site for heterologous tissues is in sharp contrast to the complete failure of transfer to other bodily regions and requires some comment. In other inoculation sites, the introduction of tissue from a foreign species is followed almost immediately by an intense inflammatory reaction which terminates either in abscess formation or in encapsulation and necrosis of the transplant. On the contrary, no immediate reaction follows the transfer to the anterior chamber. The implant remains without visible change for several days and may even undergo a slight increase in size before vascularization occurs. It seems probable that during this period the tumor stroma, representing normal tissue from the donor, dies and disintegrates. The parenchymal cells, on the other hand, representing essential tumor elements, continue to live, obtaining nutrient from the surrounding media in the manner of a tissue culture. When, eventually, the delayed reaction in the iris occurs, the implant consists only of essential cancer cells which have no species identity, and the reaction is comparatively mild, resulting in vascularization of the graft, rather

than encapsulation, as in other regions.

The ability to survive and grow in the anterior chamber of an alien host is a property common to cancer and embryonic tissue, and this property is not shared by normal adult tissue or benign tumor tissue.

Among many other interesting experiments done by the same investigator^{3, 4} were those in which transplantation of heterologous embryonic human and other mammalian tissues into the anterior chamber of guinea pigs and rabbits was successful. This ability to transplant human embryonic tissue to lower animals offers a new approach to many medical problems and is being widely employed in cancer research. Greene transplanted into the anterior chamber, in whole or in part, many individual organs taken from 10- to 30-day-old human embryos, including lung, brain, heart, stomach, intestine, and kidney. The results of brain- and lung-tissue transplantation are especially interesting. For instance, portions of cerebral cortex often grow with well-marked convolutions and gyri, which suggests that such formations are not entirely due to restricted space in the skull.

Certain changes in the eye which were reported in Greene's papers are particularly worth noting. Thus, in some of the eyes containing transplants of acinar-type breast tumor,² the cornea ruptured as the result of increased pressure, and the tumor protruded through the perforation. When this occurred, infection and regression often took place. In other instances, tumor tissue extended under the conjunctiva and invaded the vitreous chamber. The iris was always infiltrated with tumor cells, and the ciliary body was usually involved. Whereas the tumor cells extended under the palpebral conjunctiva in the older growths, the muscle of the eyelid was never invaded, nor were metastases found. In the human-fibrosarcoma trans-

plants, invasion of the iris occurred early and resulted eventually in protrusion through the iris, with occupation of the posterior chamber. Sometimes after filling the anterior chamber, partial regression was observed together with survival of cells in a particular portion, so that following a period of regression, renewed growth occurred, and the chamber was again filled with tumor.

In the case of a spontaneously developing skin carcinoma of the rabbit⁵ which was transplanted into the anterior chamber of other rabbits, it was noted that the tumor grew rapidly and that glaucoma developed early. This always resulted in premature regression of the tumor. It was also noted in the case of developing embryonic rabbit tissue⁴ that regression of the growth followed filling of the chamber, and that this appeared to be the result of progressive diminution of the blood supply incident to increased intra-ocular pressure. In two other instances, rupture of the chamber in the region of the healed corneal incision developed. In both of these the transplant consisted of developing human feet. Growth was rapid from the first, with elongation of the toes and metatarsals. The shape and structure of the feet were retained until the chamber filled, when deformation of structures occurred. In one case of human fibrosarcoma transplanted to the guinea pig's anterior chamber, interstitial keratitis and glaucoma developed⁶ so that by the 220th day the corneal opacity obscured the graft to such an extent that further observation was impossible.

One of the phases of the problem of growing transplanted heterologous tumor tissue which has not been specially considered, so far as is known, is the progressive development of the transplant within the new host. It was, therefore, determined to implant fragments of human tumor tissue—in this case, the fibro-

sarcoma, whose histologic characteristics were known—into the anterior chamber of a number of guinea-pig eyes and to remove the eyes at progressive stages of development of the tumor. It was at first planned to enucleate the eyes at stated intervals of time, but it was found that

sumed a pinkish hue, indicating the development of newly formed blood vessels. The tumor then increased in size, sometimes rapidly, sometimes more slowly, until it finally filled the anterior chamber. At this stage there was seen a regression of the tumor, or increase in size,

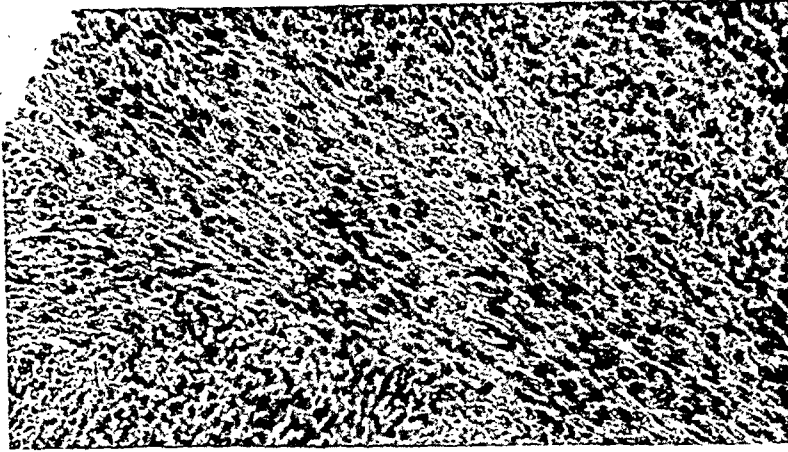


Fig. 1 (Blake). Section of fibrosarcoma from human breast.

the rate of growth was not predictable nor regular, because of factors not too well understood. Therefore, it was found better to remove the eyes when the visible growth had progressed to appreciable differences of size, and to disregard the time factor.

The tumor chosen for study was a fibrosarcoma removed in March, 1940, from the breast of a woman aged 20 years. It has been transplanted through many generations in the anterior chamber of the guinea-pig eye (fig. 1). The cells of this tissue are moderately large, with large nuclei, generally elongated, and with considerable intercellular substance. The cells show a pronounced tendency to arrangement in fascicles, some of which surround blood vessels. The fascicles cross and interlace feebly.

After the transplant was introduced into the anterior chamber, it remained without visible change for from a few days to two weeks. At this time it as-

sumed a pinkish hue, indicating the development of newly formed blood vessels. The tumor then increased in size, sometimes rapidly, sometimes more slowly, until it finally filled the anterior chamber. At this stage there was seen a regression of the tumor, or increase in size,

which finally eroded the cornea, and the growth appeared as a fungating mass. The implant always attached itself to the iris, and when vascularization de-

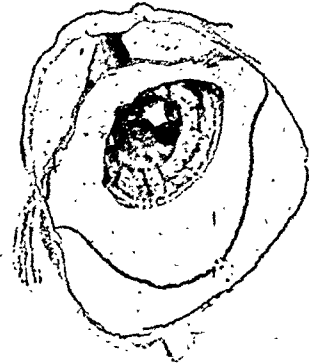


Fig. 2 (Blake). Early growth of implant into anterior chamber of guinea-pig's eye.

veloped, it arose from this structure. The invasion of the iris was rapid, the latter becoming considerably thickened and swollen. If the guinea pig was heavily

pigmented, the iris pigment proliferated and became part of the new growth, being more apparent in the posterior portion of the tumor, in closest proximity to the iris.

Figure 2 shows an early growth of the implant, which in this case did not



Fig. 3 (Blake). Polypoid growth arising from iris of guinea-pig's eye.

reach the angle of the anterior chamber but evidently became caught between the iris and the cornea. Anteriorly, Descemet's

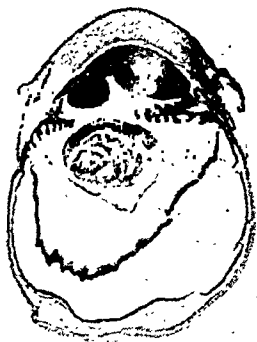


Fig. 4 (Blake). Bilobed tumor of iris of guinea pig.

met's membrane is still intact, but in places the endothelial cells are lost. The substantia propria is not invaded. The principal mass is sarcomatous tissue that resembles the original tumor in all respects. At one point, posteriorly, the involved iris has come into contact with

the lens capsule, a portion of which can be seen broken off and adherent to the tumor cells. There is inflammatory reaction in the lens, and the fibers are separated by leukocytes and lymphocytes. There is some free blood in the posterior chamber.

Figure 3 is a good illustration of the manner in which a rapidly growing implant springs from the iris in a polypoid mass. The iris on one side of the section is normal, whereas on the opposite side one sees the tumor arising from the iris near the angle, coming into contact with the cornea at one point, and extending slightly beyond the pupillary border. A small strip of Descemet's membrane is peeled off and the tumor cells are begin-

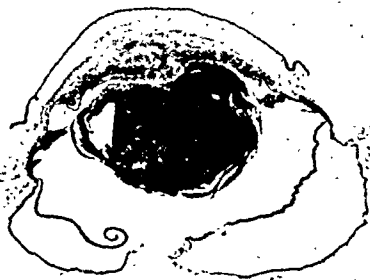


Fig. 5 (Blake). Anterior chamber filled by sarcoma.

ning to invade the stroma. On the posterior surface, the tumor lies against the lens capsule but has not penetrated this membrane. There is a foreign-body reaction in the iris at the point of origin of the implant.

In figure 4 there is seen a bilobed tumor mass which arose from the iris on one side and extended around the pupillary border to involve the opposite half of the iris. The tumor mass is highly vascular, and some of the blood-vessel walls are well developed. Again the tendency to strip off Descemet's membrane is seen. There is early invasion of the ciliary body.

Figure 5 shows an eye in which the anterior chamber is entirely filled by the growing tumor cells. The posterior surface of the iris can be plainly followed because of the pigment layer, and the site of the pupil is indicated by the gap between the pigment layer on each side of the figure. The tumor cells have extended through the pupil into the posterior chamber and have destroyed the lens capsule in this area and progressed between the lens fibers. Anteriorly, the cornea is thinned in the central area, and tumor cells have entered the stroma.

In figure 6 we see an eye which is almost entirely filled with the tumor. The cornea is a little thinned but has withstood the pressure of the growing mass unusually well. The sclera, as always, has resisted invasion. The lens has been



Fig. 6 (Blake). Globe filled by tumor.

displaced backward by the tumor until it is in contact with the sclera at the posterior pole. The retina is edematous and degenerated but not infiltrated with tumor cells. The bundles of tumor cells are characteristic of the original tumor of the breast.

Figure 7 shows a fungating mass in a disorganized globe. Anteriorly, as in every part of the eye, great changes have

taken place. At the periphery of the cornea the superficial epithelial cells are keratinized, and the deeper cells edematous. Beneath this, between the epithelium and the stroma, is an extensive hemorrhage. Nearer the center of the cornea, the



Fig. 7 (Blake). Disorganized globe with fungating mass.

tumor cells have invaded the epithelium, and, at the center, they have ruptured through and lie on the surface, mixed with polymorphonuclears. The stroma is swollen, and there are sarcoma cells scattered throughout, with many islands of blood and areas of necrosis. Descemet's membrane has entirely disappeared except for two or three short strands. The iris and ciliary processes are suggested only by pigment streaks, and the tumor fills practically the entire cavity of the globe. A few isolated bundles of lens fibers are found, but the lens has almost completely disappeared. The globe is filled with sarcoma cells, areas of infection,

and hemorrhage. At the posterior pole is a staphylomatous protrusion containing the tightly coiled retina and blood. The external limiting membrane is preserved in places. A portion of the optic nerve is seen at the tip of the staphyloma and is not invaded by tumor cells.

Figure 8 shows a section of the tumor taken from the globe described in figure

arising in the human eye may aid in furthering our knowledge of the pathology of these growths. Such experiments are already under way. The study of pigment formation may be aided by the use of the anterior chamber, for we know that a pigmented sarcoma transplanted into the eye of an albino pig continues to grow pigment, showing that the ability to pro-

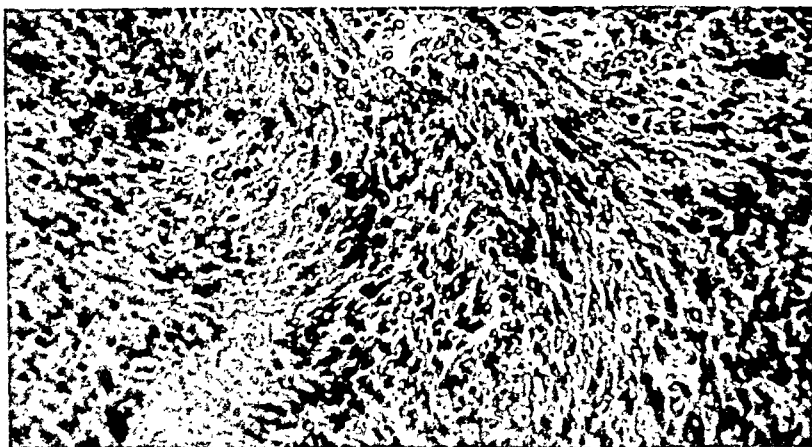


Fig. 8 (Blake). Section of fibrosarcoma taken from tissue from figure 7, showing identity of the original and transplanted tumor.

7 and is of the same cytologic characteristics as the original implant taken from the patient's breast (fig. 1).

The purpose of this presentation is not primarily to show the development of a transplant of human fibrosarcoma into the anterior chamber of the eye of the guinea pig, but to call attention to the possibilities of the utilization of the anterior chamber of laboratory animals for various research problems. Since human embryonic tissue will develop in this cavity, it should be possible to study here the growth of different embryonic tissues of the eye, as well as of other portions of the body. The ability to grow tumors

duce pigment resides in the tumor cells and not in those of the host. It may be that some of the animal parasites will grow in the anterior chamber and afford an opportunity to observe the changes taking place during their life cycle. These and many other possibilities will suggest themselves for the employment of these easily obtained laboratory animals, where changes may be observed without sacrificing the animal until needed, and where, with the naked eye or under magnification, one may follow the changes taking place.

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DISCUSSION

DR. L. T. POST (St. Louis): I am interested in this paper because in my candidate's thesis for the American Ophthalmological Society, published in the Transactions for 1924, incidental to work with the thermophore on which the essay was based, I transferred the so-called Jensen sarcoma into the anterior chambers of white rats and treated it with the thermophore at 160° for 1- and 2-minute corneal applications. In about 30 percent of the cases, the tumor continued to grow, and in most of these, if the tumor had not extended too far, the thermophore destroyed the growth. The principle has had practically no therapeutic application, except in one case of Dr. William Luedde's. The patient had only one eye and many ophthalmologists concurred in the diagnosis of melanotic sarcoma of the anterior segment of the choroid. Since the patient would not consent to removal of the eye, Dr. Luedde used the thermophore and followed the patient for many years thereafter. The last I heard about it, the patient still had the eye, and the growth had regressed. Further studies with human tissue should be made and different types of therapy tried. However, this is not by any means advocating the use of the thermophore in the treatment of intraocular tumors.

DR. BERNARD SAMUELS (New York): Dr. Blake has called attention to the experimental work that is being done by the general pathologist in the implantation of tumor and embryonal tissues in the anterior chambers of animals. He has given the results of an independent experiment of his own, undertaken for the purpose of observing the manner of growth and regression of fragments of a fibrosarcoma after they had been transplanted into the anterior chamber of guinea pigs. I agree with his theory that those elements in an implanted tumor that represent normal

tissue disappear so that only malignant cells are left to propagate. The slowness, that he observed, with which the infiltrating type grew in the iris was probably largely due to the mechanical resistance offered by the normal stroma to the advance of the proliferating tumor cells. In man, slow growth is characteristic of the infiltrating type of a primary malignant melanoma anywhere in the uveal tract. Dr. Blake noted that the pedunculated-shaped implants grew rapidly. This was due to the fact that the tumor cells were disposed in a fluid medium in which the resistance was not so great as in the iris stroma, and, furthermore, the resistance being equal in all directions, the mass assumed a globular form.

There are but two primary intraocular tumors of great importance—the malignant melanoma and the retinoblastoma.

To supplement Dr. Blake's observations, I should like to throw on the screen several slides that demonstrate the behavior, in the early stages, of fragments of primary intraocular tumors in man, once they are disseminated into the cavities of the globe. I should like to call attention also to one slide that shows how lenticular epithelial cells, free in the aqueous over a long period, have been preserved and have proliferated.

DR. EUGENE M. BLAKE (closing): I should like to thank the discussers for their remarks, and to say one thing that I think is important, and that is that it may be we can use the anterior chamber to determine malignancy. For instance, in a case of sarcoma of the soft palate of a Negro, in which portions of the tumor, implanted in the eye of guinea pigs, died in every instance, but when, within a few months, metastases occurred in the neck and portions of these were implanted in the anterior chamber, they grew in 100 percent of the animals. It might be pos-

sible to divide these tumors into the stage of dependency, when they are dependent on their host for growth, and the stage of autonomy. When they reach the stage

of autonomy, they will grow in the anterior chamber of a foreign host, and apparently will not do so in the stage of dependency.

CORNEAL ULCER TREATED WITH STREPTOMYCIN*

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The use of streptomycin hydrochloride in the treatment of corneal ulcers was suggested because of the ability of this antibiotic to inhibit the growth of both gram-negative and gram-positive bacteria. Waksman and his associates isolated two related substances, streptothricine¹ and streptomycin.² Streptomycin, obtained from a strain of *Actinomyces griseus*, is less toxic, and we used this to treat patients with corneal ulcers. Because of the limited supply of streptomycin, only those who had received previous treatment but with unsatisfactory results were classified under the category severe corneal ulcer. In order to test the possible added value of the drug as compared with the results from the usual form of treatment, nine patients with corneal ulcer were given streptomycin as an adjuvant to the routine treatment with atropine sulfate, hot compresses and, occasionally, typhoid vaccine. The control group was 13 patients with corneal ulcer who failed to respond to treatment in the out-patient department and required hospitalization. The severity of their condition was comparable to that of the patients treated with streptomycin.

The criteria were (1) duration of pain; (2) healing time of the ulcer; (3) total days of hospitalization.

Streptomycin hydrochloride[†] was used in a concentration of 10,000 units[‡] in each c.c. of normal salt solution. Two drops were placed in the affected eye every two hours day and night.

CASE REPORTS

Case 1. P. D., a white man, aged 57 years, was admitted on June 29, 1945, because of pain in his left eye beginning five days prior to admission. Vision was 6/15. There was mild edema of the upper lid and severe conjunctival injection of the left eye. The cornea was diffusely hazed throughout, and a corneal ulcer, 3 mm. in diameter was observed at the 2-o'clock position, 1½ mm. from the limbus. The ulcer stained heavily with fluorescein. Slitlamp examination revealed the depth of the ulcerous invasion as one-half the thickness of the cornea. There were numerous folds and wrinkles in Descemet's membrane, especially in the area of the ulcer.

Treatment. The following medication was ordered for the left eye: a 1-percent solution of atropine sulfate, 2 drops three times a day; hot compresses for 20 minutes four times a day; and 2 drops of streptomycin every two hours day and

[†] All of the streptomycin used was supplied through the courtesy of Merck & Company, Inc., Rahway, New Jersey.

[‡] One unit represents 1 microgram in terms of weight of pure streptomycin base according to the newly adopted plan.

* From Wills Hospital and Jefferson Medical College.

night. By the second day of treatment the ulcer was improved; only its temporal portion stained with fluorescein. The slit-lamp examination revealed clearing throughout the cornea with a smoothing of the epithelial folds. There was less pain. On the third day there was much diminished redness of the eye, the pain was gone, and only a small island of the ulcer still stained. On the fourth day the ulcer no longer stained; and by slitlamp examination only a small depression was observed to remain in the mid-portion of the healed ulcer. The use of streptomycin was stopped after six days' treatment. The patient was discharged symptom-free, with vision of 6/12. Three weeks after discharge the patient was seen in the clinic and there remained only a small nebular opacity that appeared to be clearing.

Case 2. T. J., a colored man, aged 53 years, was admitted on July 9, 1945. The patient had been well until three days prior to admission, when he developed lacrimation, photophobia, and pain in the right eye. The vision of this eye was 6/60 corrected to 6/30. Edema of the upper lid and conjunctival injection of the right eye were marked. There was a large ulcer at the 6-o'clock position, 3 mm. in size and 2 mm. from the limbus. Several deep opacities at the limbus, at the 6-o'clock position, were due to a previous perforating injury. Slitlamp examination confirmed the size of the corneal ulcer and showed it to be superficial. The cornea was hazy throughout.

Treatment. Medication prescribed for the right eye was: a 1-percent solution of atropine sulfate, 2 drops, three times a day; hot compresses for 20 minutes, four times a day; 2 drops of streptomycin, every two hours day and night. Two days after treatment was instituted, there were only very small punctate areas of staining

present within the ulcerated area, but the pain, most of the lacrimation, and swelling of the lids had subsided. On the fifth day there was no staining, photophobia, or pain. After nine days' treatment with streptomycin, the patient was discharged symptom-free, with the cornea clear except for the deep opacities observed as due to a previous injury. Vision was 6/60 corrected to 6/30.

Case 3. J. D., a colored man, aged 29 years, was admitted on July 20, 1945. Two months prior to admission, the right eye felt scratchy, and a hair was removed; but the symptoms became gradually more severe. The patient was treated as an outpatient for three weeks, but received no alleviation of his symptoms. Vision was 6/15 corrected to 6/9. There was marked epiphora of the right eye, with an edema of the lids that gave the impression of a partial ptosis. Conjunctival edema and injection were likewise severe. The corneal ulcer was 3 mm. in size and was located at the limbus at the 7-o'clock position, surrounded by a hazy infiltration. Slitlamp examination showed that the ulceration extended into the anterior third of the stroma. There were a few folds and wrinkles in Descemet's membrane in the region of the ulcer.

Treatment with a 1-percent solution of atropine sulfate, 2 drops, three times a day; hot compresses for 20 minutes, four times a day; and 2 drops of streptomycin in the right eye every two hours day and night was instituted. On the second day of treatment with streptomycin, the pain was gone and only the central part of the ulcer stained. The injection and edema of the conjunctiva were greatly reduced. Slitlamp examination showed that the edges of the epithelial portion of ulcer had curled inward toward the cornea and had become smooth. By the fourth day the ulcer did not stain, and

the edema and injection were gone. Following seven days of treatment the patient was discharged symptom-free, with vision of the right eye 6/15 corrected to 6/9.

Case 4. J. G., a white woman, aged 52 years, was admitted on October 5, 1945. Since pregnancy at the age of 34, the patient had had poor vision in both eyes. There was bilateral exophthalmos. The patient fell two days prior to admission and broke her glasses. This accident was followed by pain in the left eye. Vision in this eye was limited to perception of hand movements. Superimposed upon a leukoma at mid-cornea of the left eye was an ulceration, $2\frac{1}{2}$ mm. in diameter, which extended into the stroma and was surrounded by an area of scarring. There was a hypopyon, 2 mm. in height. The patient had hyperthyroidism, which could account for the bilateral exophthalmos. Slitlamp examination of the left eye showed a denuded area which extended into the mid-stroma. Surrounding this there was a leukoma.

Treatment for the left eye consisted in: the instillation of a 1-percent solution of atropine sulfate, 2 drops three times a day; hot compresses for 20 minutes, four times a day; and instillation of 2 drops of streptomycin every two hours day and night. After one day of treatment the pain was not so severe, but the staining was still deep. Slitlamp examination revealed, as in the other cases, that the edges of the ulcer were smooth and curled inward toward the cornea, which was in direct contrast to the rough edges that were curled outward toward the conjunctiva of the lids, noted on the first examination. The hypopyon was reduced to 1 mm. in height. Two days later the hypopyon was gone, but the ulcer still stained. There was no pain. A tarsorrhaphy was performed because of the ex-

ophthalmos, and streptomycin was continued postoperatively through the opening at the medial canthus. Twelve days after the tarsorrhaphy, the sutures were removed. The ulcer had healed, and the patient was symptom-free. Treatment with streptomycin was continued for 16 days. Vision on discharge was 3/60.

Case 5. P. G., a white man, aged 40 years, was admitted on October 2, 1945. The patient had had a corneal ulcer of the right eye in 1942, no residual scar. Four days before admission, the right eye became red and painful. The vision was 6/21. The right eye showed moderate edema of the lids and marked conjunctival injection. The cornea was hazy. The ulcer involved about one third of the cornea and stained deeply. The hypopyon was $1\frac{1}{2}$ mm. in height. Slitlamp examination revealed that the ulcer extended into the posterior part of the stroma and also that there was a small superficial opacity nasal to the ulcer, possibly the residuum of the ulcer of 1942. Wrinkles and folds were present in Descemet's membrane in the area of the ulcer, and there appeared to be active keratitic precipitates.

Treatment. Medication prescribed for the right eye included: 1-percent solution of atropine sulfate, 2 drops, three times a day; hot compresses for 20 minutes, three times a day; 2 drops of streptomycin every two hours day and night; and 1 drop of 10-percent aqueous neosynephrine, three times a day, was added to the treatment to aid in mydriasis. Following two days of treatment the conjunctival injection was only slight, and the hypopyon was smaller. On the third day, the hypopyon was one half as deep, and the pain was gone. There was continued improvement until the fifth day of treatment when, for the first time, fluorescein was noted in the anterior chamber.

Slitlamp examination showed the ulceration healing from the edges with a deep central channel. The patient did not complain of any pain. On the seventh day, no fluorescein entered the anterior chamber. Slitlamp examination revealed the ulcer to be practically healed except for the small central channel. On the eleventh day the central channel was almost closed. On the thirteenth day the patient was discharged symptom-free with ulcer completely healed. Vision was 6/12.

Case 6. I. S., a white girl aged 17 years, was admitted on August 20, 1945. One week before admission the right eye had become red and painful. Vision was 6/21. There were marked edema of the lids, conjunctival injection, and a ciliary flush. The ulceration involved almost the entire cornea. Slitlamp examination showed the ulceration to extend into the anterior portion of the stroma.

Treatment. The patient was treated with atropine, penicillin drops and ointment, typhoid vaccine, and penicillin, 160,000 units intramuscularly each 24 hours. The corneal ulcer failed to respond to this treatment. Paracentesis was performed, medication with penicillin was discontinued; but the use of typhoid vaccine was continued and that of streptomycin was started locally. After two days of treatment with streptomycin, the pain was gone. After 14 days, the area no longer stained with fluorescein and the patient was symptom-free. The patient was examined in the clinic three weeks later. The eye was white; at the site of the previous ulceration there was scarring, which reduced vision from 6/21 to ability to count fingers; there was, however, no activity of the ulcer.

Case 7. W. W., a white man aged 34 years, was admitted on July 21, 1945. The patient had had recurrent corneal

ulcers for the past year. Three weeks before admission, the left eye became painful and injected and failed to respond to the treatment previously prescribed. Vision of the left eye was 6/15 corrected to 6/9. The left eye had moderate conjunctival injection and edema of the lids. There was a large, deeply staining ulceration of the superior portion of the cornea, and many small irregular areas which also stained with fluorescein. Slitlamp examination showed the ulcer to extend into the stroma of the cornea, but the other ulcerations were superficial.

Treatment. The left eye was treated with a 1-percent solution of atropine sulfate, 2 drops, three times a day; hot compresses for 20 minutes, four times a day; 2 drops of streptomycin, every two hours day and night. The pain was gone after 36 hours of treatment. The ulcerations still stained. On the fifth day of treatment only the mid-portion of the corneal ulceration stained. It was thought that intravenous injections of typhoid vaccine would hasten recovery, and these were given every other day. Following 12 days of streptomycin treatment and four febrile crises, the ulcer no longer stained, and the patient was symptom-free. He was discharged; three months later, he had had no recurrence of symptoms, and at that time his corrected vision was 6/9.

Case 8. M. N., a white woman aged 60 years, was admitted on July 18, 1945. Two years before admission, the patient developed a right facial paralysis due to a parotid tumor. This was followed by frequent attacks of epiphora and inflammation of the right eye. Three months before admission, the right eye became red and painful, and there was a mucopurulent discharge. When this did not respond to treatment, the patient was admitted to the hospital. There was a lagophthalmos of the right eye. Vision was

1/60 corrected to 2/60. The conjunctiva was thickened and reddened with marked injection. The corneal ulcer involved the entire cornea and stained throughout. Because of the mucopurulent discharge, very careful cultures were taken, but *Staphylococcus albus* was the only bacteria cultured.

Treatment. Medication prescribed for the right eye was a 1-percent solution of atropine sulfate, 2 drops, three times a day; metaphen irrigations, four times a day, followed by liquid petrolatum; and intravenous typhoid vaccine. The ulcer failed to respond to this treatment, and a median tarsorrhaphy was performed, streptomycin drops being inserted at the medial canthus. Streptomycin was used as previously described. Due to a misunderstanding, the sutures were removed four days later, and this offered an opportunity to stain the ulcer. Only the temporal quarter of the previous ulcer stained. The pain was gone, and there was no longer any mucopurulent discharge. It was necessary to repeat the tarsorrhaphy three times because of failure of the lids to remain in approximation following removal of the sutures. During this entire period the patient received streptomycin drops through the medial canthus. It is interesting to note that the nasal portion of the ulcer healed first, the part proximal to the site of application of the streptomycin. Following 25 days of treatment the ulcer had completely healed, and the patient was discharged symptom-free. One month later the vision, with correction, was 6/15.

Case 9. B. W., a white woman aged 41 years, was admitted on October 9, 1945. For two years the patient had had recurrent inflammation of both eyes. Four weeks before her admission both eyes became acutely inflamed and sore. The right eye did not improve with treatment.

Vision was limited to perception of hand movements. The lids of the right eye were red and severely inflamed; there was some mucopurulent discharge. A staining ulcer involved the entire lower half of the cornea. There was also scarring, with some leukomas present. Slitlamp examination of the right eye showed marked haziness of the cornea throughout most of its circumference and especially in its central half. There was infiltration of the deep layers of the cornea, especially of the posterior half, with one large, dense area of infiltration involving the entire thickness of the cornea just below its crest.

Treatment. The right eye was treated with a 1-percent solution of atropine sulfate, 2 drops, three times a day; hot compresses for 20 minutes, four times a day; and 2 drops of streptomycin, every two hours day and night. On the second day the pain had gone. There was only slight staining. Slitlamp examination revealed healing at the margins of the ulcer with curling of the edges inward toward the cornea. Five days later, no ulceration was seen with the slitlamp, and no staining. The patient was discharged symptom-free eight days after the start of treatment with streptomycin. Vision on discharge was 1/60.

DISCUSSION

Although cultures were made from the ulcer margins, no bacteria grew, but cultures made from the inferior cul-de-sac showed *Staphylococcus albus* and occasional *Streptococcus hemolyticus*. The control group of 13 patients with corneal ulcer was hospitalized for an average of 20 days in comparison with an average of 15 days' hospitalization for nine patients treated with streptomycin. There were no patients in the control group whose condition was comparable to that in case 4 (corneal ulcer complicating exophthalmos), or in case 8 (neuroparalytic kera-

titis complicated by corneal ulcer). If these two cases are not considered in totaling the required days of treatment, the

TABLE 1

DURATION IN DAYS AFTER BEGINNING
MEDICATION WITH STREPTOMYCIN

Patient	Pain	Ulcer	Hospitali- zation
P. D.	3	4	6
W. W.	2	12	13
T. J.	2	5	9
J. G.	2	7*	19
P. G.	3	11	13
I. S.	2	14	28
J. D.	2	4	7
M. N.	4	7*	37
B. W.	2	5	8

* As these patients had tarsorrhaphies, it was impossible to determine the day the ulcers were healed.

treated group was under medication 12 days and the control group, 20 days. The

average duration of pain in the control group was four or five days, whereas in those treated with streptomycin, the pain was usually gone by the second day.

We were unable to determine any difference in the vision of patients whose ulcers were treated with streptomycin and of those used as controls.

It is our belief (table 1) that in the small series studied, the duration of pain was shortened, the healing of the ulcer was accelerated, and the total time of hospitalization was shortened.

CONCLUSION

Streptomycin, a nontoxic antibiotic substance derived from *Actinomyces griseus*, was found to be a useful adjuvant to the treatment of corneal ulcers with atropine sulfate, hot compresses, and typhoid vaccine.

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LEGAL OPHTHALMOLOGY*

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Every action brought into court by one person against another is based upon a duty which that one owes to the other, and failure to perform that duty. If it is a contract, the suit is on a breach of the contract. If it is a tort, it is a breach of a legal duty which the law imposes. To illustrate, when two men are driving automobiles, each owes the other a duty to exercise ordinary care. If one violates that duty to his neighbor, he has an action against the one who causes the injury. Likewise, every duty in the medical profession is based upon the same relationship. Every operation which a physician or surgeon performs is performed under a duty created by law. The law thus creates a duty on the part of every physician. The law says, in general, that it is the duty of every physician or surgeon to bring to the treatment of every case that degree of knowledge, skill, and care which a physician or surgeon in good practice would ordinarily bring to such a case in that community. That, of course, is a somewhat broad definition. In all cases, these words—knowledge, skill, and care—are used to define the duty.

A physician is not an insurer that he will make a cure. That is not part of the bargain. He is not even sure that he will improve the individual's condition. His duty is to bring to the case that degree of knowledge, skill, and care which physicians in good practice would bring. The difficulty arises in the matter of proof of knowledge or skill or care, or the lack of it; and proof of fulfillment of that duty, of course, is made before a jury. Under the constitution of our coun-

try, every person, if he chooses, has a right to trial by jury. The jury, under the laws, decides the facts. When we have a jury trial, the duties which are upon the Court are divided into two fields; the judge, decides the law, and the jury decides the facts. The jury is supposed to decide the facts, within the letter of the law, as the judge lays it down. The judge has no choice. The law is there before the case is tried, and he interprets it as he believes it to be.

In the last analysis, however, the jury decides the facts, including the question of whether or not the physician or surgeon has brought to the case that degree of knowledge, skill, and care which he should bring. It is quite obvious that most of the juries—probably all—know so little about the subject of a controversy between a patient and a physician as to be completely lost in the technicalities of the subject. Some questions are simple and some definitely not so simple. At any rate, we start out by proof first that a physician is licensed, which he has to be to give any treatment to any patient whether he charges for it or not. It is immaterial whether he makes a charge or not; his duty to his patient is exactly the same. Then he gives proof of his knowledge by showing the college where he spent so many years; that he interned at such a hospital, or practiced under someone recognized as a famous physician or surgeon; that since then he has had some special training; the nature and length of practice in a particular field; whether he is the author of any treatises or books on any subject. Proof of skill is made by proof of such facts

Proof of a physician's care, which is usually the cause of the controversy, is

* Read before the Chicago Ophthalmological Society, November 19, 1945.

made by proof of details of the particular operation or treatment that is the subject of controversy. Proof of lack of knowledge or lack of skill is not made by showing undesirable results, because the fact that there was an undesirable result, in itself, is no proof whatever that the treatment was not proper, nor that the result came from inadequate knowledge or failure to use proper care. Logically, the result, alone, proves nothing. The fact that the doctor made an improper diagnosis, which he may admit at the time of controversy was improper, or that, if he had to do it over he would do differently, does not mean lack of knowledge or skill or care. Proof of failure to furnish proper care is made only by proof of failure to do the things which a good physician, or a physician in good practice, would bring to such a case; and, therefore, the doctors hold the necessary proof in the palms of their hands. As a matter of fact, before there can be proof of failure in the duty of the doctor, there must first be proof by a qualified person who can say that proper treatment was thus and so, and that the doctor failed to follow such procedure, with a connecting link to show that his failure was the cause of the bad result that followed.

There are, of course, exceptions to that method of proof. The complainant's difficulty is that he cannot get one good doctor to testify against another—or against a bad one, so far as that is concerned—except in cases that are so flagrant that everyone realizes something has to be done. Part of this reluctance is due to timidity, part of it to fear that he may be in a similar situation some day, and part of it to a desire not to cause trouble to a fellow practitioner. As I said, there are exceptions to the rule of proof. You do not need the testimony of a physician or surgeon to prove that a doctor enucleated a good eye instead of a

bad one, or extracted a tooth that was sound instead of an aching one, or that he burned the patient with some diathermy instrument, heat lamp or something of that sort, which if properly operated would not cause such a result. There are some cases which hold that where the doctor himself operates an X-ray machine, and a bad result follows, the bad result itself is evidence of bad management or carelessness, because ordinarily these things do not happen. The thing speaks for itself. This principle first arose in connection with common carriers. If you buy a ticket and the train jumps the track, that is all the proof a passenger needs. It is up to the railroad company to show why the train is off the track. So this doctrine is made to apply to certain treatments. Some of these cases may be defended on the ground that an individual is subject to some idiosyncrasy, peculiar to him alone, such as a peculiarly sensitive skin, and the like. Not always will that be the case, because it may be the duty of the physician to find out, in advance, whether the patient suffers from some obvious idiosyncrasy. The doctrine of "the thing speaks for itself" has at times been used in cases where a sponge is left in the abdomen at operation. The fact that a sponge is left in the abdomen after operation does not, under most decisions, however, of itself create a liability. Under the law of most states, it is the duty of the nurse to count sponges, and, I think, the instruments that are used; and it is held good practice for the surgeon to rely upon the count of the nurse for sponges and instruments. He can show that he had the nurse count the sponges when he was ready to close the incision, and that she told him the count was correct. Most sponge cases are defended in that manner.

Suppose a case where an injury has been caused as a result of negligence. For

example, an elevator falls and someone has an injury, and he sues the elevator operator for that injury; and suppose, thereafter, some physician or surgeon is guilty of malpractice in his handling of the injury. The injured can file suit against the operator of the elevator and recover damages, and if the patient has exercised ordinary care in the selection of a surgeon, the operator of the elevator is liable to the person injured for the entire amount of damage, including that which resulted from poor medical practice; the reason being that the ultimate result was proximately caused by the fall of the elevator. The injured may, at the same time, file suit for malpractice and may recover from the surgeon the damage caused by malpractice. However, this is a point you might have occasion to use some time. In the event a settlement is made with the operator of the elevator, and the operator of the elevator takes a release from the injured person, the injured is deemed in law to have had a satisfaction of his cause of action, and the release taken by the elevator operator automatically releases the physician or surgeon from the charge of malpractice.

In connection with this same subject is the subject of hospitals, generally. You will have to deal with this from time to time, and we might as well cover it. Under this head, hospitals are placed in three general classifications. First, the ordinary hospital operated for profit—such a hospital, its staff, nurses, and attendants, are liable for torts on the same basis as any individual. Second, a hospital that is a charitable institution, referred to as an eleemosynary institution, not operated for profit. Under the law, a charitable hospital is not liable for its negligence or torts. Suit cannot be maintained against it for negligent acts of its staff or nurses or attendants. Its staff and nurses and attendants would be liable as would any

individuals. Under this head there have been some changes in the law.

Many of the old hospitals which had individual endowments had a very limited number of investments, but nowadays capital given to a charitable institution has to hunt around for a place to work. It is difficult to keep the money invested carefully, and at the same time make it earn anything. Chicago University is an eleemosynary institution, and it owns buildings around the city. If the neighborhood changes, all kinds of people become tenants in these buildings. Injuries occur and the University is sued. Some states divide the activities of charitable organizations into two categories. Some states excuse such an institution from liability for negligence so far as its activities are concerned with treatment of the individual. It is doing the very thing for which it was created. Yet, if such an institution is carrying on a separate business for the purpose of making money, such as renting buildings, even though the money is eventually spent for the purpose of charity, the institution is not excused from liability for negligence occurring in the course of carrying on the business, such as renting, wherein the institution earns the money.

There is a third class of hospitals, those which belong to the Government or State. One may not file a suit against the Government or State. It is true, we do have Courts of Claims, in which certain debts may be allowed, by the State, but in these Courts, a claimant does not prosecute his claim, as a right, but as a suppliant. There is no liability upon the State, nor upon any branch of the State, for negligence or torts committed in the course of governmental operations. The school board, for instance is not liable. One cannot sue the school board for whipping a child. The individuals working for these various governmental institutions are

liable in their own right personally. I remember a case wherein a patient had been sent to the X-ray room, and on the way back was simply rolled off the cart. He sustained a skull fracture and died. It was a charity hospital. The nurse had nothing, and that was the end of the case, because the hospital was not liable.

Nurses, like doctors, are duty bound to bring to the case they have in charge the same knowledge, skill, and care that nurses ordinarily bring to like cases. The only trouble is that many nurses step over their bounds. They become so accustomed to doing things that they try to do a few things extra, which doctors only should do, and get into trouble.

Hospital attendants are liable only for a failure to exercise ordinary care.

In connection with the field of expert testimony, all of you, sooner or later, will have some experience. As I said before, the facts of a case are determined by the jury. The jury has to decide first whether there is an injury, whether the fracture has healed in apposition, and so forth, or whether there was shortening, or other abnormal result. While the jury, in the last analysis, has to make a decision, the thing resolves itself frequently into a controversy between doctors. The doctor may not invade the province of the jury. The expert, the doctor, cannot tell a jury what caused the injury to happen, because the proximate cause or causal relationship between the accident and injury, or reasoning process which follows to a conclusion, is in the law a question of fact, which the jury must decide. So, we have the problem of getting the knowledge of the physician or surgeon to the jury in such form that it will enable the jury to know the facts without the doctor telling them what they have to do. We have a rule, therefore, that runs like this: Whenever, in any given field, proper conclusions can be arrived at only by a

person who has special knowledge in that field, the law allows expert testimony. That may apply to the engineering field, the electrical field, medicine, or any highly specialized field. Since the physician or surgeon may not invade the province of the jury and tell the jury what they ought to decide, we have a process of allowing the expert, in whatever field he may be, to state an opinion based upon a hypothetical set of facts as to what might or could happen. That process works in this manner: First, all the ordinary circumstances which may be supplied by a layman or the patient himself are put into evidence in ordinary terms. Then a physician or surgeon is called on behalf of the one making the claim, and he states such facts as do not deal with the opinion. Then the reasoning process is followed through by allowing the lawyer to state his hypothesis. For example, he says: "Assume, doctor, that a person who was on such a date well and hearty, had no broken bones, suffers a fall in an elevator and, thereafter, it was discovered that he had a spiral fracture of the femur between the hip and the knee; and after certain treatment it was found that the bones which were fractured are in the position indicated by certain X-ray studies interpreted here before you; do you have an opinion as to whether or not there might or could be a causal relation between the blow and the fracture as indicated by the X-ray film?"

The doctor is allowed to say what might or could happen: "In my opinion, there might or could be a causal relationship." He does not say: "There is a relationship in my opinion." He cannot say that. The judge would strike it out immediately, because that is what the jury must decide.

Remember, the questions will follow that pattern: "Do you have an opinion as to whether there might or could be a causal connection." If the doctor has an

opinion, the answer is not that it did, but that it might or could. The jury will decide whether actually it did. You may answer: "It might and it could."

This sort of anomaly in the law is qualified to a great extent by allowing the doctor, when he has stated his opinion that a certain result might or could happen, to give his reasons therefor. The doctor should be asked: "Doctor, will you state your reasons for that opinion?"

If the doctor is honest, his opinion is probably correct. The doctor on the other side may likewise give his reasons, and the jury has some logical ground for choosing between the two. If you are called upon to testify as an expert under these circumstances and the lawyer forgets to ask you for your reasons, remind him that you would like to state your reasons, because your opinion backed by reasons is worth 10 opinions with no reasons.

A hypothetical question could wander all over wide territory, but there are certain rules which govern them. A hypothetical question must come within the facts or evidence. If the evidence is not in dispute, it must incorporate all the facts. If there is any objection to the hypothetical question, the objection must say where it differs from the facts. The opinion of one doctor, for instance, is not accepted as a part of a hypothetical question.

There is also a limit to the opinion. The doctor may not speculate as to a conclusion so far as any permanent or future disability or limitation is concerned. The doctor who expresses an opinion as to what may happen must respond with a "reasonable degree of certainty," and unless he can, it is called speculation. He cannot say that it is possible that the patient might have hemorrhages or apoplexy, because it is all outside the "reasonable degree of certainty" which the law requires. Evidence which is in the realm of speculation cannot be admitted.

An attending physician may testify in answer to a specific question, as to a patient's subjective symptoms. If he has not treated the patient, he is limited in testimony purely to objective symptoms. Hearsay testimony is generally not admissible. A statement by a patient to his attending physician, however, is an exception to the rule and will be received as evidence. Anything the patient tells his physician concerning his physical condition is not hearsay. In many cases, controversy has arisen over what is and what is not a subjective symptom.

In connection with testimony by experts, the question of cross-examination comes in for a great deal of dispute. The lawyer may attempt to cross-examine on medical questions, sometimes with success and sometimes not. Ordinarily, cross-examination is limited to the subject matter of the questions asked on direct examination. Additional questions, however, may be asked, when directed to testing the doctor's memory or his qualifications in respect to the medical field in question. Under this head, a skillful lawyer can give a doctor a rather thorough examination.

Sometimes the question arises as to whether chiropractors can act as expert witnesses. They can if they show they have special training.

You may be interested in what is necessary to prove a doctor's bill. All the doctor has to do is to say that he knows what a fair charge is, and that the amount is a fair, reasonable, and customary charge for such services in the community in which he is practicing. This varies with communities, as you know.

I have had a good deal to do with expert witnesses in the medical field. You can take this advice or leave it. Doctors seem to have a feeling that their patient is theirs. They develop, in the course of treatment of a patient, a certain loyalty and love that it is almost impossible to

overcome. It is a good thing for the community that this is so, because the community gets the benefit of that love and care. Usually the doctor who does not have some of that feeling is not worth his salt as a doctor. From the standpoint of the Court and the lawyer, however, this causes trouble. When there is a controversy between a patient and another person, the doctor seems to feel that it is his moral duty to come to Court and fight that patient's battle. If the patient has a joint that is somewhat ankylosed, he is likely to say there will never be any improvement, when he knows it is not so. He feels morally justified; he is helping his patient maintain his side of the case. You may feel this is morally justified, but as a matter of fact it is the difference between right and wrong. If you come into Court and knowingly testify that a patient has more injury than he has or less than he has, you are just as guilty as if you blew a safe or stole the money out of a cash drawer. That may be hard to swallow, but it is your pill; I do not have to take it.

There is a long history connected with honesty. You may have read Breasted's "Dawn of Conscience." If you go back to prehistoric men, you will learn there was a time when man was not concerned with conscience at all. When he and his friend went into the forest, back to back, to fight wild animals or enemies, each defended the back of the other. That is how they lived, and loyalty to one another grew to be an ironclad law long before anybody thought about conscience. Consequently, loyalty to one's friends is still a trait in humanity so much stronger than honesty that people ordinarily honest, decent, and careful will tell a lie for their friends when they will not tell one for themselves. I can prove that to you. People of two different churches get into two automobiles to go home. They have a collision. The people in one car will defend that

car's driver, and likewise the other people will defend the other driver. The same is true of people riding in a street car. If there is an accident, they will defend the street car. It is loyalty to the crowd you are with. I do not blame you for that kind of view. It is natural. But, those of us who are supposed to have more moral education than others, and a greater discerning power along these lines, when called as expert witnesses, should sit down and think carefully what are the facts.

The testimony should then follow the truth, regardless of consequences.

We are also confronted with this situation: Frequently, a doctor comes into Court and has forgotten all about a particular case. When he is called upon to testify, he should take the time to check over the hospital records and the history sheet and refresh his memory. It is a nuisance, but it is his duty to do so. He picks up his notes, and the attorney objects to his reading notes. This is a legitimate objection. He is the witness, not the notes. If he does not now know what is in these notes, and if he knew at the time he wrote them, that they were correct, and that they are in the same condition as when written, the notes themselves may become evidence. He may be allowed to refresh his recollection from these notes or from the X-rays or a drawing or anything of the sort, or from anything which will, in fact, refresh his recollection. Thereafter, he may testify from his own memory, provided the thing used to refresh his recollection actually did refresh it. If he is lost without his notes, he should ask permission to review them, then put them down and tell the facts, not from the notes, but from his memory, so refreshed. I am sure all of you who call for this protection will get it.

I shall be happy to answer any questions anyone may have if I am able to do so.

DISCUSSION

DR. GUIBOR: We have considerable difficulty in getting nurses these days to aid in particular, cataract patients; are we allowed according to law to have a lay person watch that patient?

MR. HINSHAW: I think this is really a medical question rather than legal. It is the duty of a doctor to bring to his patient the care and knowledge which would ordinarily be brought to such a case by physicians in good practice. Emergencies are excusable. You may not be able to do what you would like, but your duty includes aftercare. If physicians in good practice do, as a rule, leave such cases in the care of a lay person, then in doing so you are in good practice. If they do not, you are not.

DR. SOPER: Why does the Court require the doctor to answer questions instead of allowing him to tell the facts in his own language?

MR. HINSHAW: If the lawyer who represents the side for whom you are testifying knows his business, you will not be confronted with that situation. The way to dispose of the difficulty with reference to complicated questions, is for the lawyer to break these questions up into simpler segments, and take one at a time. He can put them together when he argues with the jury. The doctor wanders out of legal bounds when he starts to talk about the medical side, without knowing the bounds.

DR. HOFFMAN: What about those questions which cannot be answered honestly "Yes" or "No"?

MR. HINSHAW: Always the witness has a right to object to giving any opinion, if, in fact, he has no opinion. He can say "I cannot answer a question Yes or No." If it cannot be answered Yes or No, usually he can say—"On that point I do not have

an opinion." . . . If you do not know what to do, you always have a right to turn to the Court and say "Do I have to answer it? May I answer it in my own way? Or may I give my reasons?" You will usually find that latitude will be allowed.

DR. MUNDT: I should like to know Mr. Hinshaw's opinion of the possibility and probability of putting over the Minnesota Plan. If we all stood there and saw an accident, there would be considerable divergence of opinion as to what we saw. It is difficult for a man who has had a patient under observation not to have arrived at a conclusion that he should do something for the patient. But, I think, at times, the lawyer falls down on calling a man as an expert witness without having had a discussion as to what was to be brought out. Men are frequently put on the witness stand without any idea as to what is being shown. In the industrial boards very frequently the file of the case is sent to you.

MR. HINSHAW: This Minnesota plan is the plan by which there is coöperation between the Bar Association and the Medical Society, for the purpose of eliminating, on both sides, testimony which is not true. The Medical Society has a committee appointed for the purpose of judging testimony which is claimed to be out of bounds. Whenever a lawyer believes such testimony has been given, he has a record made and submits it to the Medical Society. If the Committee of the Medical Society is of the opinion that the testimony does transcend the bounds of propriety or honesty, the doctor is called in for consultation and advised. If this is repeated, he may immediately be expelled. The same is true with the Bar Association; its members may be disbarred for similar actions.

GENERAL ANESTHESIA IN OPHTHALMIC SURGERY*

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Except in the case of children, local anesthesia may be used for practically all ophthalmic surgery. Having made this reservation, I shall proceed to discuss this specialized subject, "General anesthesia in ophthalmic surgery" under the following four headings in order to present the salient points without too much overlapping and to integrate the whole subject matter. (1) Patients suitable for general anesthesia. (2) Operations suitable for general anesthesia. (3) Premedication. (4) Anesthetic agents.

Patients suitable for general anesthesia. That children are best operated upon when they are under general anesthesia is a fact commonly accepted by ophthalmic surgeons. A second type of patient for whom general anesthesia is indicated is one so apprehensive, so emotionally unbalanced, that although a local anesthetic would be adequate, the psychic trauma is sufficient to warrant general anesthesia. This type is encountered in general surgery and also requires general anesthesia when operated upon for cysts, varicose veins, and the like.

Operations suitable for general anesthesia. Although it is true that local anesthesia can be employed for practically all operations, nevertheless general anesthesia is indicated in a number of instances. This is so in cases requiring extensive plastic surgery, for the local anesthesia might wear off before the operation has been completed. Acute

glaucoma could also be included in this category, not only because the pathologic change involved makes local anesthesia less effective but also because the brevity of the operation favors the use of general anesthesia. Because of psychic factors, it would be well to include enucleations also.

Premedication. Since premedication determines the course of an anesthesia, a better understanding of this subject is essential. One may approach it by asking: what does premedication try to accomplish? First, it seeks to allay apprehension. Second, it is used to lower the threshold for pain so that a smaller quantity of the anesthetic will be required. Third, drugs are used for prophylactic measures. For example, atropine or scopolamine is used to counteract the action of pentothal. Fourth, it is necessary to dry up the secretions which obstruct breathing and cause postoperative nausea and vomiting.

The drugs that are used for premedication are the hypnotics (barbiturates); the opiates (morphine, dilaudid, pantopan, codeine, demerol); and the belladonna derivatives (atropine, scopolamine). A long-lasting barbiturate such as phenobarbital may be administered on the night before the operation; a combination of morphine and scopolamine (in the ratio of 1 to 25) one hour before the operation. This point about the use of an opiate should be remembered: Its action lasts from 3 to 4 hours, so that if the operation takes one-half to 1½ hours to perform, as it usually does, the analgesic properties take effect and lessen subsequent restlessness due to pain. However, if barbiturates are given preoperatively, the postoperative restlessness will be increased, unless

* From the Department of Anesthesiology, Mt. Sinai Hospital. Read before the New York Society for Clinical Ophthalmology, November 5, 1945.

an opiate is added, for the barbiturates are not analgesics. To draw a parallelism, when a barbiturate has been administered to an obstetric patient, restlessness will follow even though there is no awareness of pain because of the action of the hypnotics.

Both avertin and pentothal are used as basal anesthetics. I prefer pentothal for children and avertin for adults. The pentothal dose is computed on the basis of 1 mg. for each 50 lbs. of body weight. The total amount is dissolved in 30 c.c. of tap water at body temperature. It is administered rectally with a tube, slowly, while the patient lies on his left side.

Anesthetic agents. Ether is the best anesthetic agent for children. It has the widest margin of safety, and the various planes of anesthesia can be closely watched. Induction may be performed by means of ether, ethyl chloride, vinethene, or nitrous oxide. For maintenance of anesthesia, ether can be given by nasal catheter, by the use of an endotracheal tube (either through the mouth or the nose), or by means of an airway fitted with an adapter to which the tube is attached. When an endotracheal tube is employed, the anesthetist is completely out of the operative field, an adequate supply of oxygen is assured, and the anesthetist can easily control the patient.

Another widely used anesthetic is pentothal sodium. The virtues of this agent have been universally acclaimed. Much has been written of its wonderful properties—easy administration, smooth induction, minimal postoperative nausea or vomiting, and rapid recovery. Although pentothal is an effective agent, it is not the drug but the anesthetist who is responsible for good results. Proper administration is, after all, the factor that determines whether the patient has a

smooth induction, an even course during surgery, and minimal postoperative effects.

Pentothal has become an excellent addition to the armamentarium of the anesthetist. It was first used clinically in 1934 by Lundy at the Mayo Clinic. Since then, its composition has not been changed, but its administration has been modified to a considerable extent. At first, a 10-percent solution was advocated. Now a 2½-percent solution is usually administered. The question as to speed and quantity of administration has also been answered. When the drug was first used, a certain amount was given for a certain number of minutes, but the dosage was never to exceed a gram. Today, however, pentothal or any other agent is given according to the needs of the patient, not according to a formula on a bottle.

A brief review of the physical properties of pentothal shows that it is broken down rapidly in the body, presumably in the liver, but how or why is not known. We do know how other barbiturates are detoxified, but not the *modus operandi* in the case of pentothal. There is a rapid induction, but no one can determine the course of the anesthesia.

Some of the complications that can occur include: hiccup, jactitation, excessive secretion, depression of respiration, nausea, and vomiting.

The following routine is employed when pentothal is the anesthetic agent: An adequate dose of morphine and scopolamine (in the ratio of 1 to 25) is given one hour before the operation. After the patient has been brought to the operating room, placed on the table, and draped, anesthesia is started. It is recommended that a local anesthetic be used, whenever possible, after the patient is asleep and before surgery begins. By decreasing the amount of pentothal that is required, the risk is minimized.

In conclusion, the following general statements may be made: The anesthesiologist has two responsibilities—to the patient and to the surgeon. While he is selecting the best anesthetic agent and the procedure best suited to the patient, he must always bear in mind that the anesthetic risk can be equal to, or less, than

the surgical risk; but it can never be greater. The anesthetist makes the surgeon as comfortable as possible, gives him a clear field in which to work, and enables him to devote his entire attention to the operation.

49 East Ninety-sixth Street (28).

KERATOCONJUNCTIVITIS SICCA*

A SEQUELA TO PURULENT ERYTHEMA EXUDATIVUM MULTIFORME
(STEVENS-JOHNSON'S DISEASE)

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AND

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Severe erythema exudativum multiforme is a disease of acute onset with fever, conjunctivitis, stomatitis, and cutaneous lesions. Its general course, although seldom fatal, is protracted, and its ocular sequelae often result in partial or total loss of vision. The etiology is obscure and pathologic findings are non-contributory.

Duke-Elder¹ lists only four cases of the purulent conjunctival form of erythema exudativum multiforme. Two of these cases were reported in 1922 by Stevens and Johnson² for whom this syndrome of the disease has been named.^{3,4} The other two cases referred to by Duke-Elder are those of Wheeler⁵ and Bailey.⁶ Further mention of this disease in the literature includes the cases of Rutherford,⁷ Ginandes,⁸ Givener and Ageloff,⁹ Rosenberg,¹⁰ Lever,¹¹ and Murphy.¹²

Throughout the literature on Stevens-Johnson's disease which we have con-

sulted, there was not mention of the relation of lacrimation to the corneal condition. Conversely, Bruce,¹³ in describing keratoconjunctivitis sicca, finds no associated skin lesions analogous to erythema exudativum multiforme. It seems, therefore, of interest to present the ocular complications of the later stages of this disease in association with deficient lacrimation and a resulting keratoconjunctivitis sicca.

CASE REPORT

T. D., an Irish-born woman aged 28 years, was admitted to the Willard Parker Hospital on April 28, 1944. The patient had been under treatment for nervous symptoms during the previous six to eight weeks, using tincture of belladonna, phenobarbital, and progynon-B. Prodromal symptoms typical of measles progressed to a state in which diffusely confluent, erythematous, maculopapular eruption enveloped the face, the neck, the trunk, and the extremities, in association with scattered, large, confluent, thin-

* Presented before the Section of Ophthalmology of the New York Academy of Medicine, on December 17, 1945.



Fig. 1 (Richards and Romaine). Poorly regrown fingernails, shown six months after the acute phase of the illness.

walled bullae filled with clear fluid. Bullae appeared also on the mucous membranes. The past history revealed that the patient had suffered from a migratory polyarthritides and had had an ovarian cyst removed.

On admission, the temperature was 103°F., and the patient was dehydrated and prostrated.

Desquamation followed the acute condition, involving skin and mucous mem-

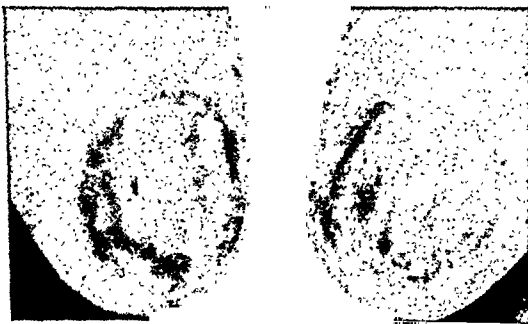


Fig. 2 (Richards and Romaine). Both index fingernails are shown in a close-up view.

branes, resulting in edema, necrosis, and mucopurulent discharge. Even the fingernails were lost (figs. 1 and 2). Bloody urine with casts, tracheal obstruction, and conjunctival adhesions occurred. The general treatment included saline infusion, plasma and whole-blood transfusions, vitamins, and the administration of penicillin.

Ocular examination. The eyes showed destruction of the corneal epithelium and adhesions between the necrotic palpebral and bulbar conjunctiva. Treatment consisted of dilatation of the pupils with atropine, irrigations of the conjunctival sac with saline solution, and instillation of

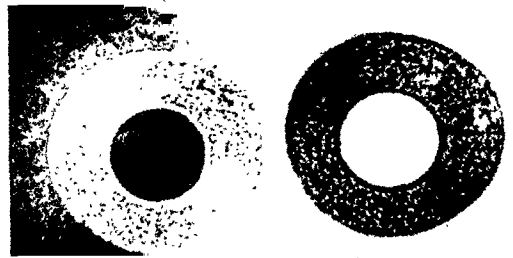


Fig. 3 (Richards and Romaine). Contact lenses are shown without corneal segments.

cod-liver oil. To combat the adhesions, contact lenses without the corneal segments (fig. 3) were employed, as suggested by one of us (H. R.).

The general condition of the patient having improved, she was transferred to a ward of the New York Eye and Ear Infirmary on June 12, 1944, for a continuation of the ocular treatment. At this time, there was pronounced photophobia. The corneas stained faintly with fluorescein. In the cornea of the right eye a macula was observed lying inferiorly; in that of the left eye there was a central infiltration. After a week, the patient was discharged for treatment in the clinic, consisting of instillations of atropine and intermittent patching of the eyes. Prog-

ress was poor, and the opacification of the corneas increased, accompanied by superficial and deep vascularization, more in the right eye than in the left. By the end of three or four weeks, a number of superficial ulcers that had developed became covered with epithelium. The corneas showed a finely stippled staining with fluorescein, visible only with the slit-lamp. Vision was reduced to 5/200 in the right eye and 20/200 in the left.

On August 4, 1944, a peritomy on the right eye was performed with an electrocautery, resulting in an immediate decrease in the vascularization and opacification, and an improvement in the vision to 20/200. The vascularization returned soon, and since the infiltration increased simultaneously, X-ray treatment was undertaken by Dr. Thomas Graham, using 75 r each week to each cornea up to a total of 900 r.¹⁴ After five doses, vascularization and infiltration were apparently reduced, but vision had decreased to 1/200 in the right eye and 5/200 in the left. Each cornea showed a finely stippled staining with fluorescein.

The patient was readmitted to the hospital on September 18, 1944, for treatment with irrigations of a solution containing 100 units of penicillin per c. c. of normal saline. This was done hourly, except during sleeping hours. The cornea of the right eye cleared considerably, that of the left slightly, and the photophobia decreased. Vision was 20/200 in the right eye and 20/70 in the left eye. After discharge, the patient's condition fluctuated between improvement and regression, with a gradual change from inflammation to healing with cicatrization. This paralleled changes in mucous membranes elsewhere in the body. Along with this change, typical signs of keratoconjunctivitis sicca appeared. The corneal epithelium maintained its stippled staining and dull-luster appearance. The

Schirmer test¹⁵ showed little or no lacrimal secretion. Routine laboratory tests were uninformative.

Local and general measures were employed in an attempt to relieve the photophobia and pain, and to prevent further ulceration, inflammation, and infiltration of the corneas, as well as desquamation of the conjunctiva from the lack of tears. The local measures employed were bland lubricants, holocaine and butyn ointments, atropine solution, dark glasses, and X-ray treatments to decrease neovascularization and to reduce infiltration. Frequent irrigations of the eyes with penicillin in saline solution were made. The general measures employed were vitamin therapy, including vitamins A, B₁, and B₂ in large oral doses for six months; pilocarpine with ammonium chloride for four weeks to stimulate secretions, progynon-B three times weekly for 10 weeks, and thyroid extract for four weeks.

The onset of manifest cicatrization was gradual, overlapping with the signs of inflammation, but exudation had definitely disappeared by the time that cicatrization signs had become apparent. Posterior symblephara, one infero-nasally in the right eye, and one supero-nasally in the left eye, occurred associated with a moderate obliteration of the fornices (figs. 4 and 5).

On November 15, 1945, a year and a half after the onset of the illness, vision was light perception in the right eye and 20/200 in the left eye. The Schirmer test showed a greatly reduced lacrimation. In the left eye superficial vascularization had increased, and the corneal epithelium still showed a finely stippled fluorescein staining, with no filaments. In the right eye, however, the cornea had undergone recurrent episodes of ulceration, until on November 10, 1945, an ulcer perforated with incarceration of the iris. On November 17, 1945, the right



Fig. 4 (Richards and Romaine). This right-eye photograph was taken six months following the onset of the illness, and shows: a, the area of early infero-nasal posterior symblepharon formation; b, the desquamated mucocutaneous junction of the lower lid; c, the injected conjunctival vessels; and d, the hazy limbus corneae inferiorly.



Fig. 5 (Richards and Romaine). The left eye shows a posterior symblepharon supero-nasally.

eye was enucleated at the New York Hospital (figs. 6 and 7).

Microscopic examination of sections of this enucleated globe, including the area of perforation, revealed a nonspecific, chronic, superficial inflammation of the cornea.

COMMENT

The findings in this case are consistent with those in Stevens-Johnson's disease, which is the purulent conjunctival form of erythema exudativum multiforme. Ac-

cording to Rosenberg,¹⁶ "differentiation of this disease at various of its phases must be made from septicemia, agranulocytosis, pemphigus, hemorrhagic measles, small-pox, Vincent's angina, and syphilis." This same author feels that "the differentiation is either apparent or readily determined or becomes manifest as the illness progresses."

The differentiation of severe erythema exudativum multiforme from acute pemphigus is difficult. Most patients with acute pemphigus do not survive. In those that do survive, the disease pursues a chronic course, and the final picture is similar to that of Stevens-Johnson's disease. In the acute stage, a Pels-Macht test¹⁷ may be used to differentiate this disease from pemphigus. In our case, it was not done. Cicatrization of the sub-

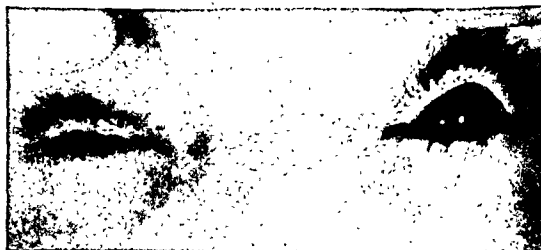


Fig. 6 (Richards and Romaine). This post-operative view of both eyes shows the empty socket of the right eye.



Fig. 7 (Richards and Romaine). The left eye in a close-up view shows a paracentral nebula, superficial corneal vascularization, and a poorly demarcated mucocutaneous junction of the lower lid.

conjunctival tissue with the formation of symblepharon and with obstruction of lacrimation is a finding common to both diseases, leading to keratoconjunctivitis sicca.

The main clinical points of differentiation of the present case of erythema exudativum multiforme from pemphigus are:

History. Ovarian dysfunction. Suspected allergy to belladonna and barbiturates.

Rash. Bullae with a surrounding erythematous halo. Symmetrical predilection for the dorsal surfaces of the hands and feet. Absence of successive crops of bullae.

Eyes. Chronic progressive course of the keratoconjunctivitis with predominance of corneal over conjunctival lesions.

SUMMARY

A case of the purulent conjunctival form of erythema exudativum multiforme (Stevens-Johnson's disease) is presented. The association of keratoconjunctivitis sicca with this disease is noted. Differentiation is made from pemphigus. Emphasis is placed on the dire ocular sequelae, with the loss of one eye and with reduction of vision in the fellow eye.

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A COMPARATIVE STUDY OF SUTURES EMPLOYED IN SURGERY OF THE EXTRAOCULAR MUSCLES*

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In an effort to evaluate the relative merits and disadvantages of the various sutures used in surgery of the extraocular muscles and to understand more fully the results obtained clinically, experiments have been performed on the muscles of rabbits' eyes and on other tissues.

In selecting sutures, size and weight rather than tensile strength have been used as criteria. When possible, sutures equipped with atraumatic needles have been utilized. In order to obtain results as comparable as possible, we have employed sutures manufactured by one dispensing house.[†] In evaluating results, we have studied the advantages, disadvantages, and the qualities of each suture, using several criteria.

The absorbable sutures used in these experiments were chromic catgut 3-0 (#1669), chromic catgut 5-0 (#1669D), and plain catgut 3-0 (#1667). The non-absorbable sutures were black braided silk 6-0 (#P242), white braided silk 6-0 (#P290), black twisted silk 6-0 (#1661), black braided silk 8-0 (#P277), twisted white cotton 3-0 (#1641), twisted white cotton 4-0 (#1273, special), Nylon 6-0 (#P336), and kaldermic plastic 8-0.[‡]

*From the Department of Research, New York Eye and Ear Infirmary and Department of Ophthalmology, Columbia University. Presented at the eighty-first annual meeting of the American Ophthalmological Society at Hot Springs, Virginia, November, 1945. Aided by a grant from The Ophthalmological Foundation, Inc.

†The authors are grateful to Davis & Geck, Inc., Brooklyn, New York, for supplying the sutures used in these experiments.

‡Basic materials for manufacture are unobtainable at the present time as they are imported.

TECHNICAL FACTORS

The qualities considered in evaluating the sutures were: (1) ease of handling, (2) adsorption and absorption, (3) tensile strength, and (4) friction coefficient.

Ease of handling. There is no question that the nonabsorbable sutures are easier to handle than the absorbable, with the exception of nylon, which is by far the most difficult in the transparent small-sized material we have used. When the absorbable sutures have been prepared by soaking before use, the difficulty is somewhat overcome; but as soon as the sutures dry, the difficulty once more prevails.

In the case of nylon sutures, the material cannot be well softened, even on prolonged soaking. Because of this factor the sutures are difficult to grasp during procedure and are inclined to twist on themselves and cause considerable annoyance in the tying of knots. If the sutures are colorless, the technical difficulties are further increased because the fine sutures are exceedingly difficult to see.

The advantage of the braided over the unbraided suture is that there is less likelihood of broken fragments of suture material being left in the tissues after removal. On the other hand, the braided sutures are hard to pull through muscle tissue, Tenon's capsule, and even conjunctiva.

Adsorption and Absorption. The factor of adsorption is more important in the absorbable sutures than in the nonabsorbable. The ability of the suture material to absorb fluid weakens the suture in proportion to the amount of fluid ab-

sorbed; therefore, the greater the absorption the weaker the suture becomes. The nylon suture, as stated above, has practically no adsorption and thus retains its original state, even in the presence of fluids.

The nonabsorbable sutures absorb a small amount of fluid, but this does not affect their strength over a short period of time.

The absorption factor or the ability of the tissues to break down, destroy, or digest the suture material is, of course, most pronounced in the absorbable sutures. The rate of absorption by the tissue may be controlled somewhat by treatment of the sutures during their manufacture. Similar conclusions were reached in the study of sutures used in corneal and scleral tissue.¹

Whereas silk and cotton sutures are broken down following the process occurring at the site of the suture implant, the condition of the nylon sutures remains unchanged.

*Tensile strength.*² The third factor, tensile strength,* is one that may vary even in a small lot of sutures. The original tensile strength, provided it is at all adequate, is sufficient in any case to handle the stress placed upon it in muscle surgery and, therefore, the other factors involved are more important in the final outcome than is the original tensile strength of each suture.

Figures on the strength of the sutures used in our experiments were obtained by finding the tensile strength of a large number of sutures and recording the mean strength (table 1).

Friction coefficient. Nylon and chromic and plain catgut sutures have the dis-

advantages of possessing a poor coefficient of friction. The surfaces of all these sutures are smooth, do not readily produce friction against themselves when knotted, and, therefore, may prevent firm apposition of wound edges. Even when satisfactory surgical knots have been employed, it is not unusual to see slipping in this type of suture. In this characteristic the cotton and silk sutures have a definite advantage because a well-tied

TABLE 1
TENSILE STRENGTH OF SUTURES

Suture Material	Size	Tensile Strength in Pounds	
		Minimum	Maximum
Chromic catgut (#1669)	3-0	3	4
Chromic catgut (#1669D)	5-0	1	2
Plain catgut (#1667)	3-0	$\frac{1}{2} \pm \frac{1}{4}$	$1\frac{1}{2} \pm \frac{1}{4}$
Black braided silk (#P242)	6-0	1	$1\frac{1}{2}$
White braided silk (#P290)	6-0	1	$1\frac{1}{2}$
Black twisted silk (#1661)	6-0	1	$1\frac{1}{2}$
Black, braided silk (#P277)	8-0	$\frac{1}{2}$	$\frac{3}{4}$
Twisted white cotton (#1641)	3-0	2	3
Twisted white cotton (#1273, special)	4-0	1	$1\frac{1}{2}$
Nylon (#P336)	6-0	1	$1\frac{1}{4}$
Kaldermic plastic*	8-0	$\frac{3}{4}$	1

* See footnote page 1126.

knot shows no tendency to slip and even a poorly tied knot has a better chance of producing satisfactory results. Furthermore, the resulting knot when tied with one of the first group is often two or three times as large as that tied with the latter group. A large knot causes mechanical irritation.

EXPERIMENTAL PROCEDURE

Extraocular surgery employed in these experiments was limited to recession with scleral fixation (retroplacement) and re-

* The Scott single-strand tester was used to obtain a mean average of tensile strength in the sutures used.

TABLE 2
RESULTS OF EXPERIMENTAL STUDIES OF SUTURES

Type of Operation	Number of Rabbits' Eyes	Sutures Used	Number of Days <i>in Situ</i>	Macroscopic State*	Microscopic State	Miscellaneous Factors
Suture implant	10	Silk (8 braided 6-0; 2 twisted 6-0)	10 days	Mild reaction	Leukocytic infiltration; few fibroblastic cells	No slipping of knot noted
	10	Cotton (3-0 and 4-0)	10 days	Mild reaction	Leukocytic infiltration; few fibroblastic cells	No slipping of knot noted
	10	Nylon (6-0)	10 days	No reaction	Fibroblastic infiltration; very few leukocytes	Slipping of knot noted in two cases
	10	Plain catgut (3-0)	10 days	Marked reaction	Massive leukocytic infiltration. No evidence of fibroblastic invasion	Slipping of knot noted in one case. Surgical knot untied in one case
	10	Chromic catgut (3-0 and 5-0)	10 days	Severe reaction	Massive leukocytic infiltration with occasional areas of necrotic tissue. No bacteria seen	No evidence of slipping of knot
Recession with scleral fixation and resection	5	Silk (4 braided 6-0; 1 twisted 6-0)	20 days	No reaction	Fibroblastic wall around suture. Occasionally lymphocyte	Sutures out in some cases†
	5	Cotton (3-0 and 4-0)	20 days	No reaction	Fibroblastic wall around suture. Occasionally lymphocyte	In one animal respiratory infection resulted in intra-ocular infection
	5	Nylon (6-0)	20 days	No reaction	Fibrous wall	
	5	Plain catgut (3-0)	20 days	Mild reaction	Leukocytic and fibroblastic infiltration with destruction of almost all suture material	Slipping of knot noted in three cases
	5	Chromic catgut (3-0 and 5-0)	20 days	Moderate reaction	Leukocytic and fibroblastic infiltration rather marked. Suture material not all absorbed	Slipping of knot noted in two cases
	5	Silk (4 braided 6-0; 1 twisted 6-0)	40 days	No reaction	Fibrous tissue replacement of suture**	
	5	Cotton (3-0 and 4-0)	40 days	No reaction	Fibrous tissue replacement of suture	
	5	Nylon (6-0)	40 days	No reaction	Fibrous tissue replacement of suture	
	5	Plain catgut (3-0)	40 days	No reaction	Very faint area of fibrous tissue replacement	
	5	Chromic catgut (3-0 and 5-0)	40 days	Mild reaction	Fibroblastic infiltration with scattered lymphocytic infiltration	
	5	Silk (4 braided 6-0; 1 twisted 6-0)	60 days	No reaction	Fibrous tissue	No evidence of sutures noted‡
	5	Cotton (3-0 and 4-0)	60 days	No reaction	Fibrous tissue	No evidence of sutures noted
	5	Nylon (6-0)	60 days	No reaction	Fibrous tissue around suture	No evidence of sutures noted. Evidence of irritation of overlying conjunctiva from points of the suture material
	5	Plain catgut (3-0)	60 days	No reaction	Fibrous tissue	

TABLE 2—(continued)
RESULTS OF EXPERIMENTAL STUDIES OF SUTURES

Type of Operation	Number of Rabbits' Eyes	Sutures Used	Number of Days in Situ	Macroscopic State*	Microscopic State	Miscellaneous Factors
Implant into skin, striated muscle of leg, heart muscle, and peritoneum of rabbits	5	Chromic catgut (3-0 and 5-0)	60 days	No reaction	Active fibroblastic infiltration	
	1	Silk (twisted 6-0)	30 days	Severe reaction	Necrosis. Strands of silk noted in fistulous tract. Bacteria seen	
	1	Chromic catgut (3-0 and 5-0)	20 days	Severe reaction	Large area involving muscles, conjunctiva and episcleral tissue, showing necrosis of tissue	No suture material found
	1	Plain catgut (3-0)	10 days	Severe reaction	Entire area necrotic	Infection involving entire periorbital tissue at time of enucleation
Implant into skin, striated muscle of leg, heart muscle, and peritoneum of rabbits		Nylon (6-0)		No irritation from sutures noted in specimens examined		

* Key to reactions: (1) Mild reaction—infiltration of small number of leukocytes and round cells, little or no edema, no marked changes in surrounding cells; (2) Moderate reaction—increased number of leukocytes and round cells, edema of the surrounding tissues with swelling and destruction of the surrounding tissue cells; (3) Marked reaction—an increase in the foregoing reaction with process reaching state of necrosis; (4) Severe reaction—large area of necrotic tissue to the extent of producing a slough.

† The sutures were either expelled by the tissue or removed in sectioning.

** Suture material absorbed or extruded and replaced by fibrous tissue.

‡ When microscopic sections were made, the suture material was apparently torn from the wound.

section operations. Sutures were also inserted into skin, striate muscle of leg, heart muscle, and peritoneum. In these experiments, cases in which infection developed postoperatively were not discarded, because we believed that it was of value to study the reactions of the sutures and the manifestations of infection. The eyes in the first group of cases were operated on by implanting the sutures without severing the muscle from its normal position, and the results were studied at the intervals shown in table 2.

Since there is a considerable variation in the size of the rectus muscles of the rabbit, the sutures were used alternately on different muscles. The superior and inferior recti were found more adaptable for experimental sutures. The oblique muscles, however, were used in many cases.

In all cases double-armed sutures were employed, and the clinical methods of recession with scleral fixation and re-

section were carried out. All sutures were tied with a primary double surgical knot followed by a square knot.

MICROSCOPIC AND MACROSCOPIC STUDY

The cases were followed and clinical evidence of reaction was observed over a varying period of time up to 60 days, and the eyes of several animals from each group were selected for macroscopic and microscopic study. The rabbit tissues studied microscopically* were examined

* The following method was used in preparing the microscopic sections: (1) Fix tissue in 10-percent formalin. (2) Place it in 50-percent alcohol for 24 hours. (3) Place it in 60-percent alcohol for 24 hours. (4) Place it in 70-percent alcohol for 24 hours. (5) Place it in 80-percent alcohol for 24 hours. (6) Place it in 95-percent alcohol for 24 hours. (7) Place it in absolute alcohol for 24 hours. (8) Place it in ether alcohol for 24 hours. (9) Place it in 1-percent celloidin (parlodion) for 6 to 8 days. (10) Place it in 8-percent celloidin (parlodion) for 6 to 8 days. (11) Place it in 15-percent celloidin (parlodion) for 6 to 8 days. (12) Place tissue in 15-percent celloidin in small jar or paper box under bell jar with

at the end of 10, 20, 40, and 60 days. A tremendous amount of work has been carried out in relation to the reaction and absorption of sutures in other tissues.³⁻⁷ Therefore, the relation of these factors in eye surgery to surgery in other parts

invasion of fibroblasts in the late stage, and the variations in these findings at different stages.

RESULTS

The type of reaction, rate of absorp-

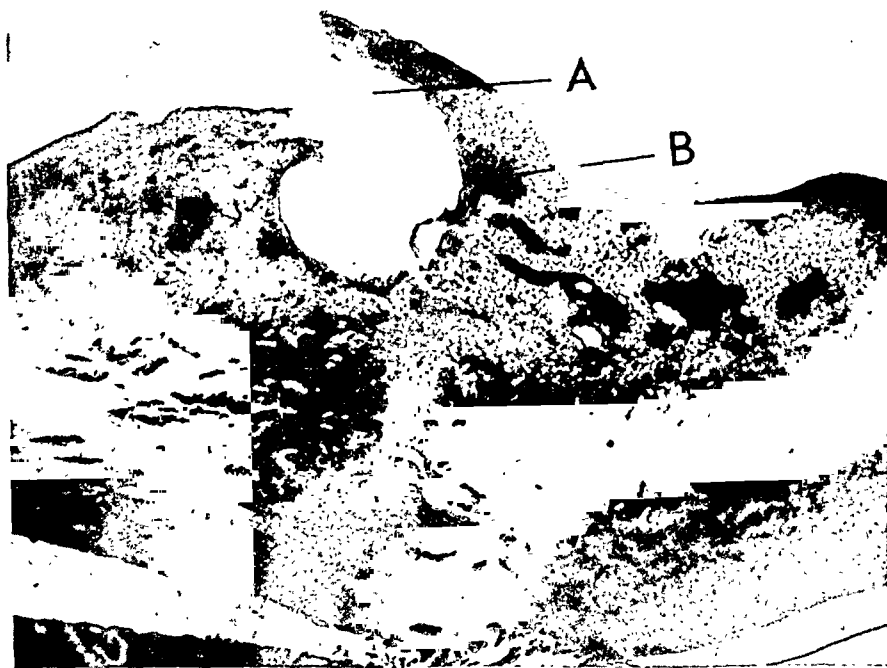


Fig. 1 (Berens and Romaine). Chromic - catgut - sutures area (10 days). * A, Area in cornea where chromic catgut was placed. B, Note marked vascular and round-cell reaction in the stroma of the cornea.

of the body was studied on a minor scale. Sutures of the same type used in the eyes were inserted in skin, striate muscle of leg, heart muscle, and peritoneum. The absorption of sutures and subsidence of reaction were more rapid in the eye than in other tissues of the body. The difference in rate, however, was so slight that it was believed to be of little significance. The method of interpreting the foreign-body reaction produced in the tissues was by estimating the size of surrounding infiltration, the presence of necrotic material in and around the sutured area, the

tion, and final state of the tissues in which the sutures were buried are shown in table 2. From this table it is evident that in every case, in the early stages, there was marked reaction in and around the absorbable sutures. In many cases the reaction surrounding the chromic catgut sutures was so great that it simulated conditions found in the presence of infection (fig. 1). The possibility that this was an allergic type of reaction was investigated by Pickrell,⁸ and it was definitely believed to be a foreign-body reaction rather than an atopic manifestation.

The reaction surrounding plain catgut sutures was less marked but was definitely greater than that when nonabsorb-

chloroform for from 24 to 48 hours until it is hard. (13) Trim extra celloidin off around the tissue. (14) Mount on a block and place it in 80-percent alcohol. (15) Cut sections with the microtome (only the area where the sutures were placed). (16) Stain sections with hematoxylin and eosin and mount them on slides with Canada balsam.

* Corneal tissue is used to illustrate the reaction to the different sutures because the degree of reaction is demonstrated more clearly than in the muscle tissue.

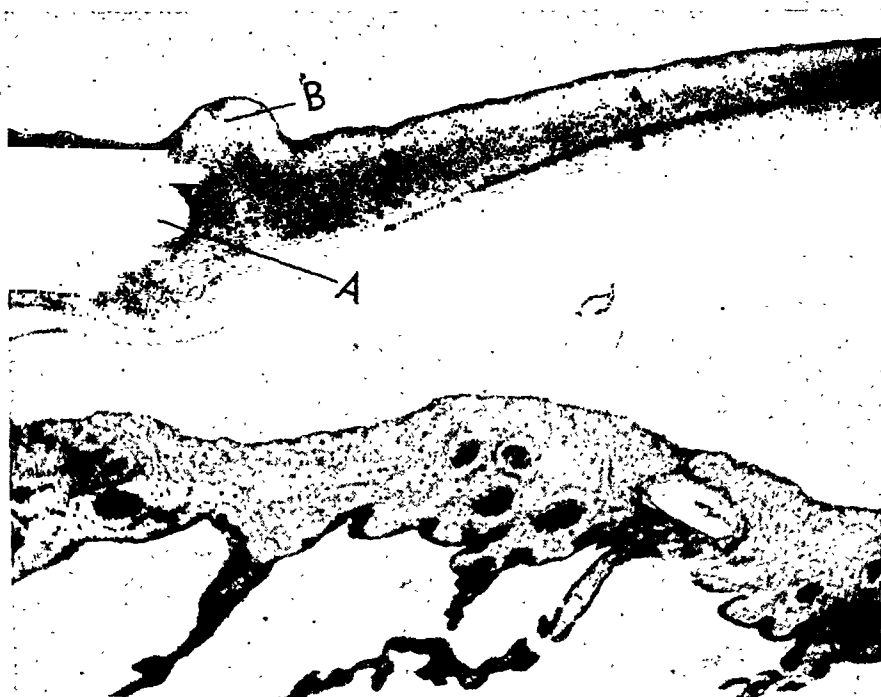


Fig. 2 (Berens and Romaine). Plain catgut-suture area (10 days). A, Area in stroma of cornea where plain-catgut suture was placed. B, Note mild reaction in the stroma.

able sutures were employed (fig. 2). This area of reaction was reduced at later stages, and there was practically no evidence of reaction at the end of 60 days in the chromic catgut sutures and at the end of 40 days in the plain catgut sutures. The suture material, itself, was usually

absorbed within 30 and 20 days, respectively.

In the case of the nonabsorbable sutures, on the other hand, the immediate reaction was far less severe, the minimal amount being seen invariably in the nylon sutures (fig. 3). Little difference was



Fig. 3 (Berens and Romaine). Nylon-suture area in cornea (10 days). A, Where nylon-suture material was placed in stroma of the cornea. B, Note absence of reaction in the stroma and epithelium.

found in the reaction to cotton and to silk sutures, although in our opinion it was slightly greater in the case of silk than in that of cotton⁹ (fig. 4). The studies at the later stages showed that the non-absorbable sutures were surrounded by a wall of connective tissue. In the pres-

this fact, because the criteria were not cultured before their insertion.

CLINICAL USE OF SUTURES

Double-armed (6-0), colorless, nylon sutures have been used by one of us (C. B.) in 59 muscle operations (table



Fig. 4 (Berens and Romaine). Silk-suture area (10 days). A, Disintegrating silk fibers in area of implanted suture. B, Tissue reaction in the surrounding area.

ence of infection, reaction was severe in all cases. This reaction was far more pronounced if the sutures were of chromic or plain catgut, and apparently less severe if of cotton than of silk. Although the plain catgut sutures are supposed to become absorbed in three days (more rapidly in the presence of infection), we found particles of suture material in the tissues after as long as 20 days.

Infection in rabbits' eyes is difficult to avoid. In drawing conclusions we have included no cases in which severe infection occurred. The relationship of the type of suture to infection is not revealed statistically, although we noted more evidence of infection when absorbable sutures were used. We do not believe, however, that this can be attributed to the sutures, but we have no bacteriologic proof of

3). The reaction has been negligible in recession with scleral fixation (retroplacement) and resection of the medial, superior, and inferior recti; but when used in lateral-rectus surgery, the ends of the sutures, unless cut unusually short, tend to elevate the conjunctiva or project through it and maintain a mild reaction until the ends are cut shorter or removed. The sutures have been found especially useful in performing retroplacement of the inferior oblique, and 35 operations have now been performed with no apparent reaction and no infection. Fine curved needles are useful in this procedure, and, because of the proximity to the macula, reaction is to be avoided. Nylon has been found far superior to chromic catgut in transplanting Tenon's capsule,¹⁰ where chromic catgut seemed to be responsible for a severe

tenonitis and a failure in one patient.

Analysis of the postoperative complications in 179 patients (117 private patients and 62 clinic patients [table 3]) revealed that severe reaction to nonabsorbable sutures is frequently the result of retained suture fragments. The criteria for recording the presence of infection were the results of cultures taken at the time of the complications. Infection oc-

The absorption of sutures and subsidence of reaction was more rapid in the eye than in other tissues of the body.

Since it was our purpose merely to point out the advantages and disadvantages of the sutures used clinically and experimentally, we have not designated one suture as better than another but merely indicated the results obtained.

1. Cotton and silk sutures are the su-

TABLE 3
COMPARATIVE STUDY OF POSTOPERATIVE COMPLICATIONS IN RELATION TO THE
SUTURE MATERIAL IN 179 PATIENTS*

Suture Material	Irritation of Overlapping Conjunctiva	Infection (number)	Severe Reaction (number)	Cyst Formation (number)	No Complications (number)	Total
Silk (of some form)	0	3	4	2	34	43
Chromic catgut	0	2	12	1	14	29
Plain catgut	0	2	5	1	40	48
Nylon	2	2	3	2	50	59
Total	2	9	24	6	138	179

* Of the 179 patients, 117 were private patients and 62 were clinic patients. Of the 9 cases in which infection occurred only three were recorded in private patients.

curred in only three operations on private patients. Of 62 clinic patients, infection occurred following 6 operations. We do not believe that the type of suture material is a major factor in the production of postoperative infection but, rather, that the major factor is contamination from some other source.

SUMMARY AND CONCLUSIONS

This comparative study of sutures employed in surgery of the extraocular muscles includes a discussion of technical factors (ease of handling, adsorption and absorption, tensile strength, and friction coefficient).

Extraocular surgery employed in these experiments was limited to recession with scleral fixation (retroplacement) and resection operations. Sutures were also inserted into the skin, striate muscle of leg, heart muscle, and peritoneum.

tures of choice when considered in the light of ease of handling, the braided sutures being preferable to the twisted type. Nylon (6-0) was found most difficult to handle.

2. From the standpoint of tissue reaction and tensile strength, the nylon suture (6-0) is the first choice and has been found most satisfactory clinically in surgery of the extraocular muscles. Fifty-nine operations have been performed. An annoying complication has been the irritation of the overlying conjunctiva by the stiff ends of the suture in operations on the lateral recti in two patients.

3. Of the absorbable sutures the advantage lies in the fact that sutures do not have to be removed, and the plain catgut produces far less reaction than does the chromic variety.

4. In the presence of infection, nylon,

cotton, and silk sutures are preferable to catgut, and chromic catgut is to be preferred to plain catgut. Experimentally, there was no marked relationship between the type of suture and infection. In those cases in which infection did develop, the greatest destruction of tissue was showed

by the absorbable sutures.

5. Both clinically and experimentally, plain-catgut sutures (3-0) are sufficiently strong permanently to attach any extra-ocular muscle under ideal conditions.

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INFECTIONS AND REFLEX DISORDERS OF THE EYE FROM DENTAL AFFECTIONS*

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Since 1940, when I¹ wrote on a similar topic, a number of papers on this subject have appeared in the literature. One of the most critical of these, by Woods,² was on the larger aspect of focal infection in diseases of the eye. These papers have caused me to reexamine critically the question of the relationship of ocular disorders to dental affections. A search of the literature on this subject reveals many contradictory statements.

BACTERIOLOGY

Rosenow³ was the first to show the widespread prevalence of the streptococci, and demonstrated how by passage through animals and media, the virulence of the germs could be made to vary. In other experiments, he proved the selective activity of the various strains of streptococci; that is, germs from foci of infection in patients suffering from uveal disease caused similar eye infections when injected into laboratory animals.

Billings⁴ became an early enthusiast for Rosenow's theories and he, more than anyone else, was responsible for popularizing and making these theories acceptable to the medical profession. According to him, a focus may remain dormant for years, because the natural defenses of the body prevent general infection; nevertheless, an insidious, slow, systemic intoxication may occur from this focal point of infection. At any time that the defenses of the body become diminished by overwork, dissipation, or exposure to cold or to trauma the latent focus may become activated. That a latent focus

may remain dormant for many years I have shown in another paper.⁵

De Schweinitz⁶ further broadened the idea when he defined a focal point of infection to be not merely an entrance for bacteria but also a place where conditions favor their acquiring the properties which give them a wide range of affinities for various structures.

Haden⁷ made apical cultures from 1,500 incisors, cuspid, and bicuspid teeth. In cultures from 400 vital teeth, only 15 percent were positive; but cultures from 600 pulpless teeth with negative X-ray findings were positive in 55.7 percent, and from 500 pulpless teeth with positive X-ray findings, they were positive in 72.4 percent. Nonhemolytic streptococci were by far the most frequent organisms found.

Chojnacki⁸ studied bacteriologically the devitalized teeth in 10 patients with iritis and in four patients with retrobulbar neuritis by injecting the infected material intravenously into rabbits. In most of the cases in which the eyes of the rabbits were involved, extraction of the teeth favorably affected the eyes of the patients. He concluded that negative X-ray findings did not rule out the possibility of apical infections.

Anastassoff⁹ found that four of six cases of iridocyclitis were of dental origin. Injecting the material from the teeth into laboratory animals produced iridocyclitis and immature cataracts in these animals.

Siniscal,¹⁰ after very careful and extensive experimental work, came to some very interesting conclusions. He found that injecting bacterial toxins from dental foci in man into albino rabbits produced

* Read before the New York Society for Clinical Ophthalmology, February 4, 1946.

no iritis; however, when he injected the bacterial organisms, iritis did develop in many cases. When he injected bacteria from the dental foci in patients who had concomitant iritis, iritis was more readily produced in the rabbits; but in rabbits which had had previous injections of bacterial toxins, the administration of bacteria produced iritis in a far greater percentage. It would, therefore, seem that the toxins diffusing into the blood stream over a period of months or years might sensitize the uveal tissue so that, later, bacterial emboli might more readily attack the tissue.

Many excellent observers have, however, come to exactly opposite conclusions.

Giani¹¹ injected many kinds of bacteria intravenously into experimental animals and found that the highest percentage of ocular involvement was produced by *B. prodigiosus*, and a very low incidence by the various strains of streptococci.

Cusumano¹² passed streptococci and staphylococci from eye to eye in a series of rabbits and later injected the germs intravenously. He found no elective affinity of the germs for the eyes.

Reiman and Hovens¹³ not only denied that the teeth could act as reservoirs of infection for other parts of the body, but they were unable, by inoculation experiments, to substantiate Rosenow's theories of elective localization.

Guyton and Woods¹⁴ after a recent survey, contrasted their conclusions with those from a survey made in 1941. They noted that the percentage ascribed to focal infection had decreased from 26.1 percent to 6 percent, and stated that this decrease paralleled their growing disbelief in the importance of focal infection as a cause of uveal disease. Brucellosis rose from a relatively unknown entity to 7.5 percent, while tuberculosis ranked

very high, 49.7 percent in the first, and 41.0 percent in the present survey.

A significant statement, susceptible to varying interpretations, was that their consultants were unwilling to lay stress on trivial and minor foci of infection, with the result that the percentage of cases of undetermined origin rose from 1.8 in the first survey to 11.0 in the last.

Schmidt¹⁵ also concluded from a study of 39 cases that chronic inflammation of the dental roots has no influence on the eyes.

REPORTS OF CLINICAL OBSERVATIONS

The average practicing ophthalmologist has been far from skeptical in relating foci of infection, particularly in teeth, to eye disorders. Indeed, Woods, one of the severest critics of the focal-infection theory, stated that: "The mass of clinical evidence is so formidable that it is difficult to dismiss it lightly on the sole grounds that it is only suggestive evidence."

The popular connection between the eye and the teeth goes back to antiquity. Wilmer,¹⁶ in an excellent historical review, reproduced a painting from the dawn of the Christian era showing St. Lucia, the patroness of sight, and St. Apollonia, the patroness of teeth, grouped together in one painting. This close connection has long been associated by the laity with the popularly known "eye tooth."

Cahn¹⁷ records that over 200 years ago, Fabricius Hildanus reported the loss of an eye from a dental abscess, and Richter,^{17a} in 1795, reported the case of a woman who was blind for several years, and then regained her sight after the extraction of a tooth.

Black¹⁸ divided the ocular lesions from dental disorders into two groups: (1) inflammation of the various tissues of the eye; (2) reflex irritations which pre-

sented themselves as sensory, vasomotor, or muscular disorders.

Moczar¹⁹ performed autopsies in 24 cases in which severe ocular complications had resulted from dental infections. He found that in the majority of cases there was a direct extension of the infection through the venous passages and, in 10 percent, the ocular infections were septicemic in origin. In other cases, ocular complications resulted from involvement of the contiguous bones or through the lymphatics.

Defong²⁰ reported two cases of orbital abscess in infants four and five months old, respectively, which were extensions from alveolar abscesses and osteomyelitis of the maxillary bones.

Wilmer¹⁶ reported several cases of uveitis that were cured when the involved teeth were extracted. There were no recurrences in any of his cases in over 10 years of follow up.

Steinbugler,²¹ in a survey of 53 cases followed for over a period of two years, found that infected teeth could cause practically any type of eye infection. There were 32 cases of uveitis, 4 of detached retina, 4 of episcleritis, 1 of retrobulbar neuritis, and other miscellaneous eye involvements.

Kieive and Reh²² reported a case of a hole in the macula in a woman, 37 years of age. Some vision returned after removal of the infected teeth. Smith²³ reported the case of a man with greatly reduced vision which cleared seven weeks after removal of two infected upper bicuspids.

Lagrange and Marq²⁴ reported a case of intractable iritis which cleared only after the infected teeth were removed. They stressed the importance of the teeth as a source of infection.

Boros²⁵ reported the case of a woman, aged 42 years, with a hemorrhage on the disc and stellate white spots in the macula

of the right eye. The greatly reduced vision returned to normal after the removal of 10 bad teeth. Kapuscinski (cited by Wilmer¹⁶) reported 51 cases of iridocyclitis which healed after extraction of the diseased teeth.

Prangen²⁶ emphasized the close relation between poor accommodation and dental disease, and Roper-Hall,²⁷ in his *Middlemore Lecture of 1941*, stated that oral sepsis far exceeded any other form of focal infection. He recommended that every ophthalmic hospital have a dental surgeon on its staff.

Krusin²⁸ reported the case of a man, aged 50 years, who had a severe corneal ulcer which did not clear up until an infected tooth was removed. He also described the case of a woman, aged 45 years, who had severe neuralgic pain and epiphora which did not clear up until a residual bone infection from an infected tooth was healed.

Green²⁹ reported the case of a man, aged 47 years, who had a retrobulbar neuritis, with extreme loss of vision in the right eye and marked loss of vision in the left eye. After several infected teeth were removed, there was a complete return of vision in the left eye but only 28-percent return of vision in the right eye.

Holman³⁰ summed up the literature on the question of focal infection, and accepted, with reservations, the relationship between primary foci of infection and remote disease. However, he felt that there was not sufficient evidence to confirm the theory of elective localization, but that the involvement of the eye might be in the nature of an allergic phenomenon, a sensitization of the eye to the bacterial toxins. Wootton³¹ also was of this opinion. It is, therefore, apparent that every form of ocular disorder has been ascribed as secondary to infections of the teeth. This question is also important when surgery of the eye is contemplated.

POSTSURGICAL INVOLVEMENT

Ellett³² stated that he had seen many eyes do badly after operation, but improve after removal of the teeth.

In this connection, one is apt to jump to conclusions too hastily, for who has not had the sad experience of postoperative infection even after eradication of all available foci? On the other hand, consider the small percentage of postoperative infections in the numerous cases in which either no search for infective foci or only a superficial one had been made. This is true not only in cases of emergency operations, on patients with acute glaucoma and on traumatized eyes, but also in the elective surgical cases; the patients with cataracts and chronic glaucoma. One must also remember that at times the removal of infected teeth is not an innocuous procedure.

Okell and Elliott³³ showed that 75 percent of blood cultures following removal of teeth were positive for *Streptococcus viridans*.

King and Lord³⁴ found that 12 percent of lung abscesses resulted from extraction of teeth; while Bender³⁵ reported a case of bilateral thrombosis of the central veins following the extraction of four teeth in a woman, 32 years of age.

NERVE PALSY

W. Russell Brain³⁶ reported a case of 3d-nerve palsy on the right side, following the removal of a right upper lateral incisor. The palsy remained partially permanent.

Bailliant and Schiff-Wertheimer³⁷ reported the case of man with a left 3d-nerve paralysis and bilateral optic atrophy who recovered vision after relief from pressure due to a localized inflammatory mass in the region of the chiasm which resulted from an arachnoiditis following removal of a lower-left-molar tooth.

Is the exacerbation of an eye disease

following the removal of an infected tooth a definite indication of an interrelationship? If they are related, is it a specific or a nonspecific-protein reaction?

I have always believed that these reactions were in the nature of an anaphylactic reaction with a great outpouring of exudate and edema. If the reaction is too severe, the function of the eye may be destroyed even though the disease process is stopped.

Woods² believes that this reaction is in the nature of a Schwartzman phenomenon: the lighting up of an inflammatory focus from a nonspecific reaction, or an allergic shock to specifically sensitized tissue.

Regardless of the mechanism, I think that such a reaction speaks for a close relationship between the infected teeth and the involved eye. Because of the danger of an overwhelming reaction in the eye, too many teeth should not be extracted at one sitting or at too close an interval, and operation on eyes should not be undertaken until healing in the region of the extraction is well advanced.

The next group of disorders are those which result from a reflex irritation of the 5th nerve. These may be due to an infective, or, more frequently, a noninfective chronic irritation in the mouth, often an unerupted wisdom tooth and may involve any part of the eye.

Krusin²⁸ quotes Henry as having found 50 cases of uveitis, out of 700, with dental disorders, and only slightly more than half of these were found to be of septic origin. Bleichsteiner³⁸ reported cases of herpes corneae due to reflex irritations of the 5th nerve, and Wilmer reported a case of unilateral complete loss of vision, cured after removal of an impacted wisdom tooth.

The most common symptom induced by these reflex irritations is a neuralgia, in-

volving either part or the whole of the 5th nerve. Rowland³⁹ claimed that the connection of the teeth and eye via the 5th nerve was a very important cause of neuralgias, either inflammatory or of reflex origin.

Resch⁴⁰ stated that the intimate relationship between septic teeth and general headaches and facial neuralgias has definitely been established. The atypical neuralgias in which the symptoms are less severe but more continuous were more definitely due to etiologic factors such as the teeth. He noted that pain sensation was peculiar to the pulp of the teeth while pressure sensation was registered entirely by the investing peridental membrane. He also felt that migraine headaches may be an allergic manifestation arising from the ptomaines or bacterial proteins from chronic tooth sepsis.

Black⁴¹ maintained that the reflex neuroses were practically always due to irritation of the vital pulp of a tooth, although an occasional case may be due to an impacted tooth. The neuralgias were, therefore, usually due to a thermal or foreign-body irritation of the exposed pulp. He stated that the pulp may be infected yet retain its vitality for a long time, explaining the relationship as follows: The pulp is enclosed in the solid dentin and cannot expand. The blood vessels of the pulp have thin walls and expand when irritated, thus pressing upon the delicate 5th-nerve endings. Therefore, in cases of neuralgia, a tooth sensitive to heat, cold, or pressure should be sought and X-ray studies made for suspected impacted teeth.

Bauer,⁴² likewise, believed that a neglected dental neuralgia may in time become a true neuralgia.

Gardner,⁴³ however, takes issue with these claims. He describes a true facial neuralgia (tic douloureux) as a lancinating, paroxysmal pain in the distribution

of one or more branches of the trigeminal nerve. Most frequently it is intraorbital at the start and later spreads. It affects both sexes about equally and is bilateral in 20 percent of the cases. Because of the location of the pain and its resemblance to the pain caused by a drill on the pulp, the teeth very early are looked upon with suspicion, particularly because an attack is frequently incited by chewing or touching a tooth. In spite of these seeming connections, he claims that no dental condition, however neglected and aggravated, can cause tic douloureux. These sufferers usually have had several and even all teeth removed to no avail, but he holds that a tooth may act as a so-called trigger zone.

It seems to me that any irritation of the 5th nerve is a real neuralgia, whether it is from an unknown cause, the so-called tic douloureux, or from a cause which can be found and eradicated. The pain from the latter can be just as severe and disabling.

REPORT OF CASES

CASE 1. C. I., a woman aged 33 years, came to the office on April 5, 1936, because of an itching of both eyes which had recurred for the past few summers. A diagnosis of vernal catarrh was made and appropriate medication was prescribed. On April 30, 1938, the patient returned because the right eye had been red and painful for one week.

Examination disclosed a patch of scleritis adjacent to the nasal side of the cornea. At this time, she also gave a history of recurrent pains in her joints.

The dental report was as follows: A lower premolar had definite bone abscess, and when removed, free pus was visible. In the upper jaw three nonvital teeth were removed, two of which had putrescent canals.

The scleral infection disappeared com-

pletely within two weeks and has not recurred since. When last seen, on March 15, 1941, fine vitreous opacities were the only remaining evidences of the previous infection.

CASE 2. A. P., a man aged 58 years, came to the Beth Moses Hospital, complaining of pain and redness in the right eye. In 1934, he had been treated by the medical department for rheumatism. He was referred for complete checkup for possible focal infection.

Examination revealed vision to be: O.U., 20/20. There was a scleritic nodule at the temporal side of the cornea of the left eye. This was tender to touch.

A dental checkup revealed many infected teeth. These were treated. The scleritis was cured and has not recurred since then.

CASE 3. A. McL., a woman aged 42 years, came to the office on February 5, 1939, complaining of a sandy feeling that had been present in both eyes for many weeks.

Examination showed vision to be: O.U., 20/200. There was a superficial punctate keratitis involving both eyes. Every tooth possessed by the patient had bad apical infection. Over a period of two months all her teeth were removed. The punctate keratitis began to improve almost immediately after only a few of the teeth had been removed. She has had no recurrence of the condition since then.

CASE 4. W. R. H., a man aged 55 years, came to the office on February 8, 1945. About a week earlier he had developed a pain on the left side of his forehead followed by pain and redness of the left eye. At the present time, the pain had disappeared but he now complained of poor vision in that eye.

Examination. Vision was O.D., 20/50,

improved to 20/25; O.S., 20/200, not improvable. The cornea was hazy and showed many deposits on the posterior corneal surface. The iris was hazily seen. Atropine and hot compresses were prescribed. Two days later tension in that eye rose to 55 mm. Hg (Schiotz), and the appearance of the eye was not changed. The following day the tension was 35 mm. Later that day a tooth was removed, followed by the removal of another tooth four days later. The eye began to improve rapidly, and in less than two weeks, the eye was cured.

CASE 5. H. L., a woman aged 32 years, came to the office on May 16, 1945, because the left eye had been red and painful for five days. She stated that she had never had trouble with either eye before.

Examination. Vision was O.D., 20/20; O.S., 20/70. The left eye showed marked circumciliary injection. There was a dense opacity of the cornea in the pupillary area with deep vascularization. There were many "mutton-fat" deposits on the posterior cornea.

The patient was referred for a complete physical examination, including a tuberculin test and dental checkup. The general physical examination and tuberculin tests were negative, but X-ray films of the teeth revealed an abscess around the upper left premolar. It is interesting to note that the patient at no time complained of pain or tenderness in this area.

Following removal of the tooth, the eye became more red and painful, and the patient felt as if a foreign body was in her eye. Soon the latter began to improve rapidly, so that by July 5, 1945, the eye was white, the deep vascularization had regressed, and the deposits on the posterior cornea had completely disappeared. However, there was still present a fine opacity of the cornea in the pupillary area. Vision was 20/25.

CASE 6. C. I. R., a woman aged 39 years, came to the office in May, 1937, with a history that four nights previously she was awakened by a severe pain in the right eye. This pain, lasting a minute or two, had since recurred several times a day.

Examination. The right palpebral fissure was slightly wider than the left. Corneal sensation was equal in both eyes. Vision was normal, and no pathologic process was found. The next day, the pain was more severe and atropine (1 percent) was instilled although there was no real basis for so doing. In two days, the pains had disappeared completely, and both palpebral fissures had become equal.

On September 15, 1937, the patient returned because of extremely severe recurring pain in the right eye for the past two days. She stated that since her last visit she had had pain every day.

Examination. The cornea of the right eye presented a diffuse desquamation of the epithelium. Local therapy and a thorough but vain search for focal infection were instituted. However, an X-ray film of the mouth revealed an upper right impacted wisdom tooth, which was removed. The cornea cleared up in two weeks. The patient has since remained completely free of symptoms. Her last visit was on May 7, 1944, for a refraction.

CASE 7. F. R., a woman aged 53 years, was originally seen on December 26, 1936, when glasses were prescribed for compound myopic astigmatism.

On February 5, 1939, she returned because the left eye teared a great deal, was sensitive to light, and felt irritated constantly. Her symptoms began a day after an upper left premolar tooth had been extracted, a week before.

Excepting for an eye which was sensitive to light and which teared excessively,

no pathologic change was found. Her symptoms did not disappear until about three weeks later; evidently not until complete healing had taken place in the tooth cavity.

CASE 8. E. S., a woman aged 18 years, came to the office on June 6, 1937, because the eyes felt strained and the right eye had been bloodshot, on and off, for the past year.

Examination was completely negative excepting that the cornea of the right eye and the right side of the face were more sensitive to the touch than the left.

On December 4, 1937, she returned because the pain in the right eye had become severe. The eye showed no pathologic lesion. X-ray examination of the jaw showed that a wisdom tooth was progressing and would probably erupt.

About a year later the tooth erupted, and the pain disappeared. Corneal sensitivity in both eyes became equal.

CASE 9. M. W., a man, aged 38 years, came to the office on August 2, 1943, with a history that for the past several months he had been awakened frequently during the early morning hours by an excruciating pain in the left side of the head. This pain was accompanied by blurring of vision in the left eye. A diagnosis of glaucoma had been made by an ophthalmologist, and he was under treatment with miotics, without amelioration of the symptoms.

Examination. There were no evidences of glaucoma, and no other ocular causes for the pain were found. The patient was referred for a dental checkup, and this was reported as negative.

The neuralgic pains became more frequent and more severe, so that when seen again on October 3, 1944, the patient was extremely despondent. He had lost a good deal of weight and was about to sell a

very successful business which he had spent many years in building up. He was intending to move to the South West in the hopes that a more favorable climate would help the tic douloureux which had been diagnosed.

The patient was again advised to have the teeth checked, but with negative results. In as much as the dentist scouted as absurd the possibility of a connection between the pain and the teeth, I felt that the examination was not conscientiously made. The patient was advised to have another dental opinion.

This examination showed some absorption around an upper left bicuspid, and when this tooth was removed, the infection was found to be much more marked than the X-ray film had indicated. The patient has not had a single attack of pain or blurring of vision since the infected tooth was removed.

CASE 10. S. S., a woman aged 39 years, came to the office on March 17, 1945. A few weeks before a foreign body had been removed from her left eye. It was not embedded. Since then there had been very severe pain in the eye and tearing. No pathologic change was found to account for the symptoms. Hot compresses to the eye were advised.

On March 27, 1945, the patient returned for a refraction and gave the information that about a week after her earlier visit to the office, she had gone to the dentist, who found a very badly infected upper rear molar on the left side. After removal of this tooth, the pain and the tearing disappeared as if by magic.

CASE 11. S. S., a woman aged 49 years, came to the office on April 30, 1938, because of headaches and recurrent severe lancinating pain on the right side of the face. These pains had been present ever

since the removal of the canine tooth on that side.

Ocular examination was completely negative. X-ray films of the jaw proved that the root of the canine tooth had broken off during removal and was still present. The neuralgic pains and headaches disappeared completely upon removal of this root.

CASE 12. R. B., a woman aged 19 years, came to the office on May 3, 1939, because she had had recurrent attacks of pain on the left side of the face for the past month. These were sharp and lancinating in character. They began at the lower part of the face, shot up to the eye, and lasted for a few seconds at a time. Her father, who was a physician, had had her thoroughly examined, but no cause for these attacks were found.

Examination. Vision was O.U., 20/15. The eyes were completely negative for pathologic change. X-ray films of the teeth disclosed an erupting wisdom tooth in the upper left jaw. The dental surgeon advised no interference because it was coming through normally. In a few months the pains had completely disappeared and have not recurred since.

CASE 13. E. E., a man aged 32 years, came to the Brooklyn Eye and Ear Hospital on April 17, 1945, with a history that, a week before, a lower right premolar and an upper right rear molar were extracted because they were abscessed. Soon after the extraction, the right eye became blurred, and the following day he developed pain above that eye.

Examination. Vision was O.U., 20/20. There was a moderate circumciliary injection of the right eye. The anterior chamber was slightly hazy, and the iris markings were not well delineated. A mild iritis was diagnosed, and the pupil was

dilated. A few posterior synechiae were easily ruptured, and with the usual local therapy the eye was completely healed in a few days.

CASE 14. W. L., a youth aged 17 years, came to the Brooklyn Eye and Ear Hospital on November 15, 1937, at which time glasses for compound hyperopic astigmatism were prescribed. Vision with the glasses was 20/20. On March 18, 1939, he returned because annoying spots had appeared before the right eye for several weeks.

Examination. No change was found in his refraction or vision; there were numerous fine opacities in the vitreous. A complete check for focal infection revealed a cyst in the roof of the mouth. This was removed in the dental department.

He was last examined on June 22, 1939, at which time he stated that the spots were not annoying him any more. Examination showed that fine vitreous opacities were still present but that they were greatly reduced in number.

CASE 15. L. R., a woman aged 43 years, came to the Brooklyn Eye and Ear Hospital on March 25, 1939, because vision in the right eye had been reduced for three weeks.

Examination. Vision was O.D., 20/50; O.S., 20/20. There was a patch of exudative choroiditis in the lower periphery, and the vitreous had many large opacities. Examination at the dental department disclosed abscesses of the right lower bicuspid and the left lower molar. Both teeth were removed.

When last examined, on April 27, 1939, only some fine vitreous opacities remained in the right eye and vision was 20/20.

CASE 16. H. G., a man aged 36 years,

came to the office on April 13, 1939, because he noticed that vision in the right eye had suddenly become blurred three days before.

Examination. Vision was O.D., perception of shadows; O.S., 20/15. There was a large patch of exudative choroiditis, temporally, and the vitreous was full of large opacities. There was also a detachment of the retina, above and temporally.

Examination of the mouth showed four upper teeth on the right side to be abscessed, and the jaw under one of the teeth was badly infected.

The teeth were removed, and the jaw scraped. The choroidal exudate cleared up. The opacities became fine and scanty, but the detachment increased in extent and was considered inoperable.

CASE 17. R. L., a woman, aged 40 years, came to the office on May 9, 1931, stating that vision had begun to fail in the right eye one week ago. On the day before, vision suddenly became much worse, and the eye was painful. That night she could not sleep because of pain on the right side of the forehead.

Examination. Vision was O.D. perception of hand movements; O.S. 20/15. There was marked circumciliary injection. The cornea was steamy, and the interior chamber shallow. The pupil was dilated and did not react to light. There were no spots on the posterior corneal surface. The fundus was not visible. Tension was 25 mm. Hg (Schiotz), in the right and 12 mm. in the left eye.

A 0.5-percent solution of eserine was instilled in the right eye until the tension was reduced to 15 mm. and the pupil became contracted. The patient left the office completely free of pain, taking with her a prescription for 2-percent pilocarpine, which she was to instill every hour. On the way home she developed

very severe pain on the right side of the head but she did not return until two days later, at which time the pupil was very irregular and there were many deposits on the posterior corneal surface. Tension was 30 mm. (Schiotz). A diagnosis of iridocyclitis with secondary glaucoma was made. The pupil dilated easily, and a large patch of chorioretinitis in the lower temporal periphery was noted. As the mouth appeared to be in very poor condition, a dental checkup was advised. Almost every tooth had apical infection, and the dentist removed six teeth at one sitting. Soon after, she experienced very severe pain in the right eye and, when seen the next day, the fundus was so full of exudate that no details could be made out. In a few days, the lens became opaque and swollen and the anterior chamber shallow, but there was no increase in tension.

When she was discharged from treatment on October 19, 1931, the eye was white, the lens opaque and glistening white. On December 31, 1936, she returned because of pain in the right eye and forehead, present for two days. The cornea was steamy, and the anterior chamber practically absent. Tension was 60 mm. Hg (Schiotz). A peripheral iridectomy was performed at the Brooklyn Eye and Ear Hospital the same day. The eye has since remained white and

free from pain. When last seen, on October 10, 1945, she had uncertain light projection.

CONCLUSION

In my opinion, the eyes are closely related to the teeth and, in a fairly large percentage of cases, are involved by dental infections. This relationship holds true not only for the frankly infected teeth but also for the devitalized teeth. Reflex irritations of the 5th nerve from dental conditions can cause severe facial neuralgias which may be indistinguishable from the true *tic douloureux*. It may also result in a pathologic picture simulating inflammatory conditions, particularly of the cornea.

Indiscriminate sacrificing of teeth should be avoided, and the opinion of a dental surgeon should be sought. Radical dental surgery, such as the removal of many teeth in too short a time, should be avoided because of the danger of an overwhelming reaction in the eye and the subsequent destruction of sight. The indiscriminate removal of teeth before an eye operation is not warranted. However, teeth showing definite apical infection should be removed. If there is a history of past infection of the eye from focal infection, the devitalized teeth should also be removed.

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CONJUNCTIVITIS ASSOCIATED WITH ERYTHEMA MULTIFORME BULLOSA

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The multitudinous terminology used in the designation of disease entities in dermatology has led to a somewhat confused state in regard to the ophthalmologic aspects of some of these diseases. As early as 1866, von Hebra¹ described a skin condition, called erythema exudativum multiforme, which is characterized by an eruption of the face, neck, and the extensor surfaces of the hands, forearms, and legs. Constitutional symptoms were rare or absent. Apparently, ocular signs were also absent or were too insignificant to mention. Yet the literature, though relatively meager, has persisted in the use of this term, with its association to definite inflammatory signs of the conjunctiva. It is apparent that so broad a disease entity as erythema multiforme would be described in a variety of forms, some as affecting one part of the body and others designated as having an affinity for particular organs. Thus, dermatologists have noted that one of the rare forms of this disease not only presents the typical exanthem, but also shows vesicular lesions affecting the mucous membrane of the mouth and of the eyes. This form is characterized by marked constitutional symptoms (fever and prostration) which further distinguish it from the original form described by von Hebra. Furthermore, it has been noted that this rare form of erythema multiforme affects the mucous membrane without involving the skin.² In 1922, Stevens and Johnson³ described a "new eruptive fever associated with stomatitis and ophthalmia." Following this report the condition was frequently referred to as Stevens-Johnson disease. Murphy⁴ described the condition and believed it to be definitely a

pediatric condition. Ageloff,⁵ using the term of erythema multiforme bullosa, reported that this condition occurred (in the reported cases) in an age group of 22 months to 16 years. Other cases, reported since Stevens and Johnson, have used a varied, descriptive nomenclature.

It is noteworthy that only the American literature reports a close association of the disease with sequelae destructive to the eyes. In Edmund's⁶ opinion serious ocular complications were rare and, when they did occur, were caused by secondary infection. In this country, however, destructive lesions were noted by Stark,⁷ Wheeler,⁸ Bailey,⁹ and Rutherford.¹⁰

The disease called erythema multiforme is known to occur in several forms. One that is typical, which may well be termed erythema multiforme bullosa, is characterized by a sudden onset, fever, and prostration, a typical iris eruption, a vesicular stomatitis, and a diffuse conjunctivitis of varying degrees. The vesicles of the mucous membranes of the mouth soon rupture, leaving a raw inflamed area. The fauces may be inflamed and edematous. The conjunctiva is usually involved to some degree but, as a rule, somewhat mildly. Severe types may show chemosis, subconjunctival and conjunctival hemorrhage, and, occasionally, corneal ulcer and symblepharon. The causative agent is unknown, and all reports in the past have noted normal or variable laboratory findings, including blood counts, blood culture, smears and cultures of the lesions, and chemistry of the blood.

A probable causative factor was suggested by Chick and Witzberger¹¹ who because they found Vincent's organisms, believed that spirocheticidal therapy

ought to be tried in such cases. Other workers have not been able to verify this relationship.

That erythema multiforme bullosa is not a rare disease is evidenced by the admission to a hospital of seven cases within a period of six months. These seven cases need not be reported in detail since the symptoms are entirely typical and similar in each case so far as the dermatologic aspect is concerned.

Case 1. A man, aged 18 years, was admitted to the hospital with a case of nasopharyngitis. His temperature was 100.4°F. Examination revealed injection and swelling of throat and uvula and vesicles on the mucous membrane of the mouth. Some of the vesicles had ruptured, leaving raw inflamed areas. There was one ruptured vesicle on the glans penis. The conjunctiva was mildly injected, with slight mucoid nonpurulent discharge. The patient was entirely cured within three weeks. The conjunctivitis was treated with boric irrigations and instillation of 5-percent sulfathiazole ointment.

Case 2. A man, aged 18 years, was admitted to the hospital with a case of nasopharyngitis. His temperature was 101.4°F. The conjunctiva, moderately injected, secreted a mucoid discharge. Within 24 hours, vesicles developed on the buccal surfaces, and the mucoid conjunctival secretion became slightly purulent. Smears taken from the mouth and fauces were positive for Vincent's infection. The patient was entirely cured in 13 days. Treatment consisted of nicotinic acid (200 mg. daily). Ocular treatment consisted of boric irrigations and sulfathiazole ointment.

Case 3. A man, aged 24 years, was admitted to the hospital with a case of Vincent's infection. Examination revealed

bullae and ruptured vesicles of the mucous membrane of the mouth and of the penis. He gave the history of having had three previous attacks, always occurring in the spring and fall. The conjunctiva was mildly injected, and there was a slight mucoid discharge. In this case, it was thought advisable to observe the effects of a course of penicillin. He received 1,000,000 units (intramuscularly) within a period of three days. No unusual effects on the course of the disease were noted.

Case 4. A young man, aged 21 years, was admitted to the hospital with the diagnosis of a case of thrush. He gave a history of having had his first attack of the disease in the spring of 1941, four years previously. Since then he had had a yearly occurrence in the spring of each year. At admission: only mouth and penile lesions were noted, but within five days the typical skin picture was presented. Among the bullae in the mouth and on the glans penis were several which had ruptured. The patient's temperature never rose above 99°F. The conjunctiva was mildly injected, with a mucoid discharge. The patient was well in 14 days, receiving the usual treatment of nicotinic acid combined with calcium gluconate. The ocular treatment was the same as in the other cases.

Case 5. A man, aged 23 years, was admitted to the hospital with an upper-respiratory infection. The patient complained of irritation of the eyes and throat. Examination revealed bullae of the skin, the buccal surfaces, and on the glans penis. The conjunctiva in this case was intensely hyperemic and hemorrhagic, both bulbar and palpebral portions being involved. There was a constant flow of bloody secretion from both eyes. The tears were deep scarlet in color, giving a startling effect as they ran down his

cheeks. The patient was acutely ill and prostrated. His temperature varied between 101° and 103°F. The conjunctiva was bathed every two hours with a penicillin solution (500 units per 1 c.c.) followed by an instillation of 5-percent sulfathiazole ointment. Systemic treatment was the same as for the other cases. Within three days the profuse secretion ceased, and the conjunctiva became less hemorrhagic. Within five days, the latter appeared entirely normal. There was no corneal involvement at any time. No sequelae were noted. Fourteen days after admission, there were still some bullae in the mouth and on the glans penis, but they appeared deflated. Eighteen days after admission the temperature dropped to normal. There were, however, bullae still present in the mouth.

Case 6. A young man, aged 23 years, was admitted to the hospital with a case of nasopharyngitis. He presented the typical iris lesions on the soles, abdomen, trunk, arms, and legs. The lesions were maculopapular with vesicular centers. There was one small bulla in the mouth. This patient had no ocular complaints, and results of ocular examination were entirely normal. However, he received the same treatment as the other patients.

Case 7. This patient, a man, aged 24 years, experienced the acute episode of this disease at another camp. His record indicates that he was admitted to the hospital in a state of severe prostration, with a temperature of 103°F. He had a profuse vesicular and bullous eruption involving most of the skin and buccal surfaces and the conjunctiva.

COMMENT

Several interesting points were brought out from the record of the first six acute cases seen: (1) The range of age in this

group was from 18 to 24 years. (2) All cases occurred in males. (3) In two of the six cases, smears from the mouth and fauces showed Vincent's infection. (4) From a systemic viewpoint, five of the cases were comparatively mild; yet they presented bullous lesions in the mouth, and four of them on the glans penis. All five of these patients complained of conjunctival irritation, and all showed mild hyperemia. In no case was the secretion frankly purulent.

Of the seven cases, case 5 was the most severe. There was marked prostration, fever, and dramatic bleeding from the conjunctiva. The secretion, however, never became purulent.

All patients received warm boric irrigations followed by the instillation of 5-percent sulfathiazole ointment into the cul-de-sacs. The one severe case was treated, in addition, with instillations of a penicillin solution every two hours. None of the patients suffered severe ocular complications. All were treated systemically with nicotinic acid and calcium gluconate and one received 1,000,000 units of penicillin (intramuscularly) without remarkable results.

Four of the six cases showed little, if any, skin lesions. The manifestations were confined to the mouth and penis. These four can truly be designated examples of Stevens-Johnson disease.

All of the patients, when admitted to the hospital, were diagnosed as having either nasopharyngitis or Vincent's infection, indicating that some degree of generalized malaise and upper-respiratory symptoms were always present.

The degree of involvement of the mucous membranes of the mouth did not parallel the systemic course of the disease.

Laboratory studies of all cases resulted in normal or variable findings, including blood counts, blood culture, and smear and cultures of the lesions.

The seventh case, which was not seen here during the acute phase, was the only one to exhibit any destructive sequelae. This case had been described as presenting vesicles involving the conjunctiva. When seen here, there was a marked deposition of connective tissue confined to the palpebral tarsal conjunctiva of all the lids. The connective tissue was laid down in whorls, strands, and plaques, so that little normal conjunctiva could be recognized. There was no symblepharon. The patient complained bitterly of conjunctival irritation and the Schirmer test revealed a marked deficit in the lacrimal floor.

CONCLUSIONS

The conjunctivitis of erythema multiforme bullosa has been recognized as an entity and has been given a varied and bizarre terminology. The condition is frequently observed, and when disassociated from typical skin lesions is probably not recognized. Each of the cases here reported was associated with some degree

of catarrhal conjunctivitis, but none became malignant and destructive, as has frequently been described by various writers. The cause is as uncertain now as it was to von Hebra in 1866. In one of my cases, treatment with penicillin brought about no remarkable improvement. The conjunctivitis apparently is checked by either sulfathiazole or penicillin therapy but, in the series reported, this treatment appears to be prophylactic rather than curative. There seems to be no question that the disease is accompanied by a definite systemic disorder, which may, in turn, invite a secondary infection, causing some of the virulent effects reported in the literature.

The association of herpes simplex to erythema multiforme, as recently reported by Anderson,¹² may also give some clue to the cause of the more serious cases. It remains to be seen whether the advent of sulfa drugs and penicillin will have any deterrent effect upon virulent cases.

238 West Wisconsin Avenue (3).

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NOTES, CASES, INSTRUMENTS

RETINAL VENOUS SHEATHING IN MULTIPLE SCLEROSIS: REPORT OF A CASE

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Since the description by Rucker,¹ in 1944, of sheathing of retinal veins in some cases of multiple sclerosis, no confirmatory reports have appeared in the literature. The case to be reported here resembles those he described and seems

Repeated ophthalmoscopic examinations showed no evidence of any inflammation of the nerve head. On June 9, and July 14, 1944, notations were made that no perivenous sheathing was found. On the latter date, six weeks after the onset of visual loss, the acuity and fields were normal. The tentative assumption at this time was that this was the first episode in multiple sclerosis and that in later years other symptoms would present themselves.

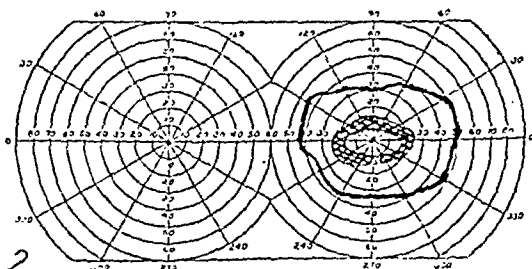
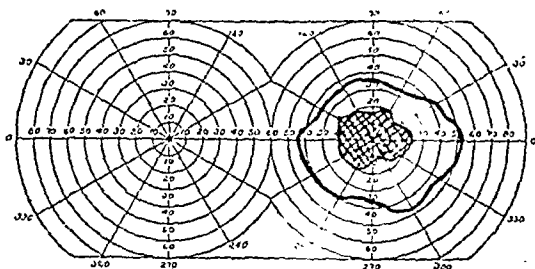


Fig. 1 (Johnson). Fields plotted on June 9, 1944, with 35/330 white target. Dense central scotoma and peripheral contraction in right eye. Fig. 2, Fields plotted on February 3, 1945, with 3/330 white target. Ring scotoma.

to shed light on the nature of the sheathing. Stimulated by the aforementioned article and having had the privilege of observing some of the cases there reported, I was on the lookout for retinal venous sheathing in the cases of multiple sclerosis which came under my observation.

REPORT OF CASE

A white woman, aged 20 years, complained on June 5, 1944, that she had lost the vision of her right eye three days previously. Visual acuity in the right eye was reduced to perception of motion and that of the left was 20/20. Fields were charted weekly for five weeks. Perimetric fields, plotted on June 9, 1944, with the 35/330 white target demonstrated a dense scotoma in the field of the right eye (fig. 1).



Fig. 3 (Johnson). The fundus of the right eye on November 6, 1945, showing two small white plaques overlying a branch of the superior temporal retinal vein about four disc diameters from the nerve head. The dark shadow below the center of the picture is an artifact.

On February 3, 1945, there was again a diminution of visual acuity in the right eye, vision being 20/40 in the right eye and 20/20 in the left. At this time there was a ring scotoma in the field of the right eye (fig. 2). Ophthalmoscopic examination disclosed a moderate pallor of the optic disc, but only a suggestion of pallor in the disc of the left eye. No evidence of perivenous sheathing was found.

In March, 1945, a neurologist, after making a complete examination, confirmed the diagnosis of multiple sclerosis. On October 26, 1945, fields were again plotted and found to be essentially normal. Visual acuity was 20/20 in each eye. By means of the ophthalmoscope, how-

ever, definite sheathing was observed along both superior and inferior temporal branches of the retinal vein in the right eye, about four disc diameters from the nerve head. Two of the plaques are shown in figure 3.

This case indicates that the thin sheathing of retinal veins encountered in some cases of multiple sclerosis is not congenital tissue, but that it appears during the course of the disease of the central nervous system. Rucker,² in a second series, had no case such as this, in which careful ophthalmoscopic examination had been made prior to the finding of sheathing, and thus was unable to state when it appeared.

839 Belgrade Avenue.

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TANTALUM ENUCLEATION IMPLANT

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The high incidence of enucleations observed in the Armed Forces has accentuated the problem of orbital implants. I have used vitallium spheres and lucite spheres and have also observed post-operatively their use by other surgeons. The percentage of rotation out of the muscle cone was frequent enough to be considered disappointing. The percentage of extrusion of the implants was also disproportionately large. I have not used nor seen the results of the implant described by Eggers.¹

After observing the many excellent results obtained by the brain surgeons in using tantalum plates in repairing cranial defects, I was prompted to experiment

with the same element in making orbital implants.

Tantalum has a characteristic bluish-gray color, having a density of 16.6 gm.

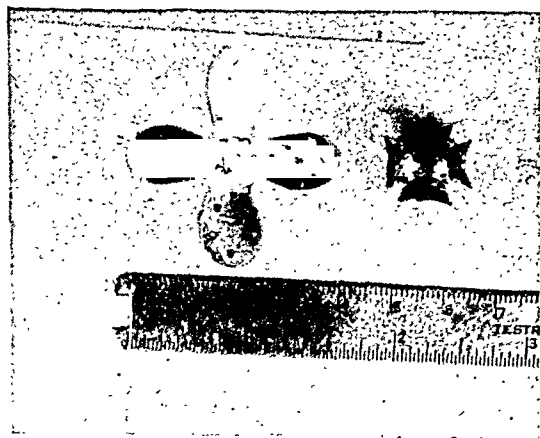


Fig. 1 (Jensen). Four-leaf pattern of tantalum, and leaves bent to form a round cup.

per cubic centimeter. It compares favorably with stainless steel in its drawing,

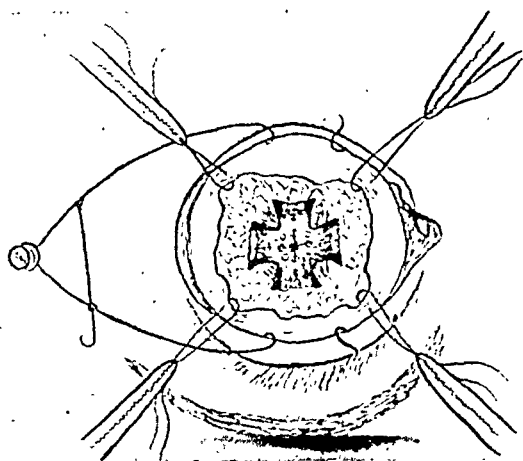


Fig. 2 (Jensen). Operation to insert implant.

stamping, or forming characteristics. The chief value of tantalum to the surgeon lies in its chemical property, which permits cells to obtain their normal growth unhampered. Some investigators have demonstrated the attachment of fibroblasts to the metal itself.

The implant was made by using a .015-in. thickness of tantalum. With the aid of tin shears, a four-leaf pattern was made (fig. 1). The plate was then bent into a round cup shape with concave-shaped leaves.

The enucleation operation was performed in the usual manner. The four recti muscles were tied separately, and the insertions were drawn anterior to the equator of the implant. The muscle sutures were inserted through the perforations and tied over the center of the im-



Fig. 3 (Jensen). Good socket the result of tantalum implant.

plant. Considerable care was exercised in closing Tenon's capsule with interrupted catgut sutures. The conjunctiva was closed with black-silk, mattress sutures (fig. 2).

This procedure was used in seven cases. During a period of six months, no rotation or extrusion was observed. The implant obtained an excellent socket (fig. 3), allowing good rotation.

1315 Medical and Dental Building (1).

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PENETRATING WOUNDS OF THE CORNEA WITH HYPOPYON TREATED WITH PENICILLIN

CASE REPORT

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N. B., a boy aged 6½ years, on August 28, 1945, received a penetrating injury to the cornea of the right eye from a steel table fork. He was seen by me the next day. Examination showed a hard eye with two penetrating wounds of the

cornea, 4 mm. apart, in the 1- and 8-o'clock positions. The epithelium and substantia propria surrounding the wounds were cloudy. The iris was torn in two places opposite the corneal wounds. The anterior lens capsule was split in its upper third, and swollen opaque lens fibers extruded through the rent. A 3-mm. hypopyon was present. There were ciliary injection, lacrimation, and photophobia. Visual acuity was: R.E. light projection; L.E. 20/50+2 corrected to 20/20 by a +1.50D. sph. \ominus +.50D. cyl. ax. 90°.

The fundus of the right eye could not be seen because of the cloudy media. No foreign body was found. The other fundus and media were normal.

The hypopyon was a direct result of infection introduced by penetration of the anterior chamber. The lens was injured, infected, and offered an excellent medium for the development of suppuration. The glaucoma was due to a narrowed filtra-

sion was made in the cornea, 2 mm. below the limbus, at the 12-o'clock position. The anterior capsule of the lens was entered by the keratome. The anterior synechiae were broken by a spatula, and a complete iridectomy at the 12-o'clock position was performed. Thirty cubic centimeters of normal saline, followed by 20 c.c. of penicillin solution containing 3,300 units per c.c., were flushed through the an-

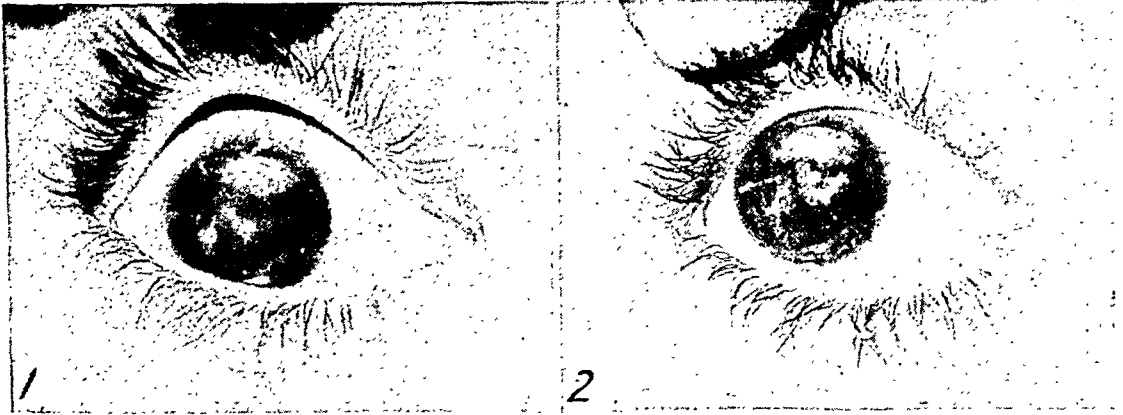


Fig. 1 (Ingalls). Photograph of left eye on the fifth postoperative day, showing considerable lens cortex in the anterior chamber. Fig. 2, Photograph of left eye two months after operation, showing secondary membrane in pupillary area.

tion angle produced by the swollen lens, combined with obstruction of the trabeculae by a plasmod aqueous. Two anterior synechiae, between the injured iris and corneal wounds, were present.

The operation selected was a linear extraction of the lens with complete iridectomy. Substitution of a solution of penicillin for the usual saline irrigation was the innovation which may be of value in this type of case.

Following avertin and ether anesthesia, the skin of the lids and brow was prepared with iodine and alcohol. Solutions of argyrol and adrenalin were instilled into the conjunctival sac; Castroviejo lid clamps were applied; a superior-rectus bridle suture was passed. A fixation forceps was applied below the limbus at the 6-o'clock position, and a keratome inci-

tion was made in the cornea, 2 mm. below the limbus, at the 12-o'clock position. The anterior capsule of the lens was entered by the keratome. The anterior synechiae were broken by a spatula, and a complete iridectomy at the 12-o'clock position was performed. Thirty cubic centimeters of normal saline, followed by 20 c.c. of penicillin solution containing 3,300 units per c.c., were flushed through the an-

terior chamber. This washed out the hypopyon and several fragments of lens material. A drop of 3-percent atropine was placed in the conjunctival sac, with an ointment of calcium penicillin containing 1,000 units per gram. Both eyes were dressed and protected by a double Ring mask.

An injection of 1,500 units of antitetanus serum was given intramuscularly at the time of operation, and typhoid vaccine, in the amount of two million organisms, was given intravenously the following morning, 14 hours after the anesthesia.

On admission, rectal temperature was 100.6°F. and, the following day at 12 o'clock, was 101°F. (a questionable reaction to the foreign-protein therapy).

On August 30th, at the first dressing,

the anterior chamber was filled with cortex, and there was a moderate post-operative reaction.

On the following day, the iris pillars were in good position, and the anterior chamber was still full of cortex. On September 1st, the cornea had regained its normal luster.

At this time intramuscular injections of penicillin were started as an additional safeguard; 10,000 units were given three times daily and continued for six days (a total of 170,000 units).

On September 2d, some absorption of lens cortex had taken place; the hypopyon had disappeared; the anterior chamber had completely re-formed and no anterior synechiae were present.

Three days later, considerable cortex remained in the anterior chamber (fig. 1), and the question of the advisability of reopening the corneal wound for further irrigation with penicillin was considered; however, after consultation with Dr. John H. Dunnington, it was decided to await developments.

Improvement continued, and the patient was discharged from the hospital on September 10th.

The eye continued to improve, and examination on October 29th showed a clear cornea, except for two scars, a small

string adhesion between the temporal pillar of the iris and the upper corneal wound (fig. 2). There was an atrophic area in the iris, at the 8-o'clock position, which extended along the pupillary border to the 9-o'clock position. The central area of the pupil was partially occupied by thickened lens capsule dotted with pigment; the temporal iris border of the pupil was adherent to the lens capsule by a narrow posterior synechia. Tension in each eye was normal to fingers.

On October 31st, an estimate of 2.00 diopters of irregular corneal astigmatism in the right eye was obtained by the use of the Javal ophthalmometer (this was not accurate because of poor coöperation). With a correcting lens of +7.00 diopters before the right eye, the patient could count fingers at three feet. The fundus could not be examined because of the presence of a secondary membrane, but there was a good reflex. The fundus and media of the left eye were normal.

At a later date, a discission will be done. The remaining synechia may be separated at the same time.

This report is made to call attention to the possible value of this method of therapy in cases of infected penetrating wounds of the eye.

635 West 165th Street (32).

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

LOS ANGELES SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

SECTION ON OPHTHALMOLOGY

September 17, 1945

DR. ORRIE E. GHRIST, *presiding*

THE ROLE OF GLASSES, AMBLYOPIA, ORTHOPTICS, AND SURGERY IN THE TREATMENT OF STRABISMUS

DR. SAMUEL ABRAHAM reported on a study of 551 cases of nonparalytic divergent strabismus in which the error of refraction of the two eyes was not sufficient to warrant a consideration of aniseikonia as a factor. He stated that no ocular pathologic change was present. In other words, his report covered all cases of strabismus in which the error of refraction in the two eyes was approximately equal and in which it could be presumed that at the onset of the condition the vision was probably equal in the two eyes. Dr. Abraham said that glasses were prescribed in 307 of these cases with resulting straightened eyes in 109 (35.6 percent). As to the types of cases, 115 were of the periodic type; 192 of the constant type. Eight patients (69.5 percent) of the periodic type were helped by glasses alone, according to Dr. Abraham, whereas 29 (only 15 percent) of the constant type were helped by glasses alone.

The results were considerably better when the cases were treated within six months of the onset, especially those of the unilateral constant type. Among 144 cases of the unilateral type of constant strabismus, only 12 (8.3 percent) responded to glasses when treated more than six months after the onset. When treated within six months of the onset,

which, he said, happened too infrequently, 45.9 percent responded to glasses.

Examination of the cases revealed that those helped by glasses showed considerably less difference in corrected vision in the two eyes than those not helped by glasses. The difference in vision between the two eyes in those helped averaged about 0.3, whereas the difference in vision of those not helped averaged 0.6.

An improvement in vision by treating the amblyopia in the cases of unilateral strabismus resulted in cure of strabismus in 29 out of 60 cases so treated. In 30 of the 31 remaining cases, the vision in the ametropic eye improved to within 0.1 of that of the other eye, with the result that the strabismus became alternating. It was obvious, according to Dr. Abraham, that treatment of the amblyopia was a definite help in the cure of strabismus and results of the surgery showed that the time taken to give such treatment was well spent.

Surgery in 51 cases resulted in a cure in 45 cases (88.2 percent); that is, functional cure, not cosmetic cure. No case was considered ready for surgery in this group of cases unless the vision in the two eyes was approximately equal.

Orthoptics in Dr. Abraham's report was limited in its meaning to that form of treatment which aimed to reeducate the cerebral area in the production of normal binocular vision and definitely did not include treatment with glasses or treatment of amblyopia. In no case where orthoptic treatment alone was given were any results seen. Where orthoptics was combined with treatment with glasses and amblyopic treatment, the results were never better than in the large group of

cases herein reported without recourse to orthoptics. The results of surgery reported were the results in patients given no orthoptic treatment.

Dr. Abraham's report emphasized that functional cure could be obtained in a very high percentage of cases after error of the refraction, the amblyopia, and the possible structural defects had been given proper attention.

He concluded that there seemed to be no need for considering orthoptics in the treatment of most cases of the nonparalytic convergent strabismus seen.

Discussion. Dr. Harold F. Wahlman pointed out that enthusiasts of one or another method for treatment of strabismus tended to overemphasize their own talent or subject. He agreed with Dr. Abraham that it was necessary to consider all the methods of treatment for strabismus and to use all of them to advantage.

Dr. Wahlman raised the question as to whether the amblyopia in strabismus might not often be due to a mild retrobulbar neuritis which occurs in the course of exanthematous diseases in childhood. It was common knowledge, he said, that the history of a squint frequently contained reference to its onset following an exanthematous disease in childhood. He queried whether the retrobulbar neuritis might not be temporary or permanent, and in its permanent form might not explain some of the cases of amblyopia ex anopsia that were resistant to occlusion or other forms of orthoptic therapy.

Dr. Wahlman emphasized that many of the structural changes in cases of strabismus seen at the time of operation, might be hereditary. He stated that he had frequently been perplexed to explain why many patients' strabismus straightened out very well under the anesthetic before the operation had been performed, when the fusion faculty had been eliminated by the anesthetic. He was interested to know

if anyone could explain the mechanism of such straightening.

Dr. C. H. Albaugh said that he had frequently found it difficult to understand the structural changes seen at time of operation in strabismus of short duration, and was often concerned as to what part this might play, particularly in view of the principle elucidated by Dr. Walter Lancaster of Boston; namely, that each extraocular muscle is more powerful than would be normally required by the job it has to do. Dr. Albaugh also mentioned the factor of partial paralysis of elevator muscles as playing a part in the cause of strabismus.

Dr. Abraham, in closing, said that he had not had sufficient time to discuss the problem of hyperphoria in strabismus, but that he felt that it was very unreliable to try to measure any such hyperphoria in the presence of a high degree of squint because of the tendency of an eye to drift in any direction. He said that he was unable to agree with Dr. Wahlman concerning retrobulbar neuritis as an explanation for amblyopia ex anopsia, but did not wish to take up the time to discuss his reasons for disagreement.

C. H. Albaugh,
Reporter.

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

October 1, 1945

MAURICE L. WIESELTHIER, M.D.,
presiding

THE MARK J. SCHOENBERG MEMORIAL MEETING

Dr. Schoenberg, one of the founders of the New York Society for Clinical Ophthalmology, and its first president, was devoted to phases of ophthalmology in which he had performed pioneering work and in which he had a special interest.

CHECKING OF TONOMETERS.

DR. ADOLPH POSNER set up a tonometer-checking station for the first part of the instructional hour.

EXHIBIT ON GLAUCOMA

The National Society for the Prevention of Blindness presented an exhibit on glaucoma to complete the instructional hour.

GLAUCOMA: SOME SUGGESTED ETIOLOGIC FACTORS

DR. FERDINAND L. P. KOCH presented a modified summary of unpublished notes and data of Dr. Mark J. Schoenberg as a synopsis of some of his views concerning etiologic factors of glaucoma. Dr. Schoenberg established a syndrome of symptoms from disturbances of metabolism within the tissues of the eye which altered the equilibrium of the mechanism regulating the intraocular pressure, resulting in a lowering of the threshold within the eye to the stimuli from various parts of the body.

Dr. Schoenberg believed that there must be some missing factor which probably would be found in a consideration of a principle of general physiology which may be stated as follows: (1) the exchange of food and stimuli between that organ and the rest of the organism; (2) the performance of the special function determined by its own anatomic structure. Thus, the function of any organ depends not only upon the impulses, nutrition, and stimuli that are received from the rest of the organism but also upon its independent, specialized, and, therefore, complex structure, which functions as a sort of governor, permitting the organ to maintain its purposive function despite external interference or even lack of external assistance, while simultaneously modifying the effect of stimuli from elsewhere.

The "principle of relative organ autonomy" implies, in the eye, the existence of a stabilizing mechanism to reduce to a proper and harmless degree the continuous stimuli reaching it. This is particularly important since food and stimuli constantly are entering the visual organ in various quantities and intensities, and this would result in varying degrees of functional inefficiency if no regulatory mechanism were present for constant maintenance at a certain level of both nutrition and tension. These levels may vary slightly within very narrow limits.

Certain circumstances or conditions external to the eye—such as: emotional aberrances, abnormalities of blood pressure, physical fatigue, decreased systemic resistance with inflammatory episodes, endocrine disturbances as well as those of metabolism, and others—which may induce some elevation or depression of the intraocular pressure beyond the limits of normal, may manifest themselves in the eye through alterations of: (1) capillary pressure in the uvea; (2) vascular permeability; (3) impairment of ocular drainage; or (4) some combination of the three. The fact that the intraocular pressure, in the great majority of such general situations as have just been mentioned, tends to remain within normal limits appears to suggest the presence of an ocular-tension-stabilizing mechanism. Similarly, since it is not sufficient merely that nutrition, stimuli, and hormones be brought to the tissues, but that these be utilized normally, it might be assumed that a local regulatory factor for these activities must be present.

The theory of an autonomous mechanism assumes that a certain substance or substances are available constantly to control ingress and egress of fluids, gases, and stimuli that determine the normal maintenance of intraocular pressure as

well as the normal metabolism of lens, vitreous, retina, and optic nerve. This assumption implies the secretion of a substance produced in the ciliary processes, which alone of the ocular tissues have a location and form, in addition to their physiologic and histologic characteristics, suited to the secretion of such substances. The functions of these secretions are presumably capillarotonic, neurotrophic, and the maintenance of equilibrium between ocular-fluid inflow and outflow.

The inability of the vitreous to absorb more fluid than it already contains can be reconciled with the many indications that swelling of the vitreous occurs in glaucoma by assuming that the ciliary processes furnish to the vitreous an increased amount of so-called residual protein which seems to constitute its hydrophilic substance.

The continued progression of glaucomatous optic atrophy after a successfully performed decompression operation, which should be arrested if hypertension were the only cause, may indicate the presence in such eyes of a toxic substance that continues to effect a failing of the function of the neurotrophic-producing substance of the ciliary processes necessary for the nutrition of the optic-nerve fibers.

Relaxation of the capillary tonus with dilation increases capillary permeability. In addition to the remote control of the vegetative nervous system, it is conceivable that the ciliary processes furnish a secretion, the failure of which results in various degrees of capillary dilation.

Draining of the ocular fluids (aqueous, intercellular fluid, and venous blood) is, then, more than merely a mechanical problem. Normally, only as much blood as the tissues demand enters the finest arterioles and capillaries, and the local venous system is adequate for its drainage. Similarly, only as much aqueous as the pectinate

ligament, Schlemm's canal, and the perivascular spaces can drain off enters the eye by filtration, dialysis, or secretion. The delicate adjustment is inhibited or stimulated through the vegetative nervous system and the substances furnished by the ciliary processes. If the latter fail, the efficacy of the drainage system may be greatly reduced.

Accordingly, the factors determining maintenance of normal intraocular pressure and nutritional equilibrium are: (1) capillary circulation; (2) physico-chemical constitution of the blood; (3) mechanical agencies and structure of the globe; (4) the secretion of the ciliary processes. Any one of these may undergo alteration, with subsequent incoördination of the others, and produce various types of glaucoma which may be classified as belonging to the vascular, metabolic, drainage, mechanical, and secretory, or to the mixed groups. Buphthalmos would be placed in the drainage category; acute glaucoma in the vascular and secretory group; simple glaucoma in the secretory group only; an absolute glaucoma would represent terminal stages of the mixed types.

Another principle of general physiology is that stimuli will have an effect upon a given tissue or organ only when their intensity is sufficient to cross the threshold of resistance, which varies within definite and narrow limits. It is chiefly in organs that are congenitally inferior or diseased that the stimuli are able to cross the threshold and produce symptoms. One of the fundamental changes in glaucomatous eyes is the lowering of the threshold against the entrance of depressing stimuli originating in any part of the organism. Diseases of other organs or systems are not directly the cause of glaucoma, although if deviations from the normal are present in the eye and the threshold is lowered to stimuli which ordinarily would

produce no pathologic effects, they may unchain the glaucoma syndrome. This fact justifies the use of many provocative procedures which indicate no abnormal results in normal eyes, but which yield hypertensive values in glaucomatous eyes when, presumably, the threshold is lowered to the entrance of stimuli from both within and without the eye.

EXPERIENCES IN SCLERAL RESECTION

DR. DONALD W. BOGART said that Dr. Schoenberg was the first ophthalmologist in this country to attempt the operation for the cure of retinal detachment. He had studied at the Gonin Clinic in Zürich and returned to this country to be the first to perform Gonin's operation at the Knapp Hospital.

The need for a new technique in the surgery of retinal separation has long been apparent. This new procedure may be designated, for want of a better name, "scleral resection for the relief of retinal detachment." It assumes a shrinkage of vitreous with a resultant need for shortening the globe slightly to meet the detached retina with its adhesions to the vitreous. The operation is performed as follows: The sclera is cleared of the appropriate rectus muscle in relation to the detachment. Silk sutures are placed in the muscle for later replacement to its cut stump. Tenon's capsule and any adhesions are cleared.

A 5 by 12 or 14-mm. segment is marked, overlying the equator at the site of the detachment. If such a piece is over the long posterior ciliary artery, part of the segment is removed above and part below it. Two "whip-type" sutures, tied at the ends and placed so as to overlap the proposed incision, are left untied at the middle part. Pulling the two loose ends enables one to close the incision in the manner of lacing a shoe. Tying may be done at any time, if complications

should arise. These sutures are laid aside to permit clear view and removal of the segment. The incision in the sclera is made down to the choroid with a specially designed knife, the blade of which has a sharpened end and a serrated side that guides the surgeon as to the depth of the incision. The latter is made laterally for 5. to 10 mm. and then lengthened to the ends of the marked segment on one side by a scleratome designed especially to protect the choroid by cutting only with its sides.

After exposure of the choroid, the segment is removed with scissors. New forceps have been developed to hold the sclera while this incision is made. Usually, at this point, the subretinal fluid evacuates itself, because of cystic or thinned choroidal areas. The sutures are now drawn up, tied (reinforcement sutures may be used if necessary), and buried.

The area about the closed wound is surface coagulated with a specially designed spatula heated in an alcohol lamp. A limited area is coagulated; the needle is retempered by plunging it at once in sterile alcohol. One or two igni punctures are made with a needle heated in the flame to make certain that all subretinal fluid is evacuated. Ophthalmoscopic control is used during the operation. This procedure is simpler than is diathermy puncture, produces less general ocular reaction, and causes less discomfort to the patient. The muscle is sewed in place, sutures are buried, and the conjunctiva is sewed with running silk. If a tear is present elsewhere, it is sealed off with three or four igni punctures. As a final procedure, 1 c.c. of sterile air is injected into the anterior chamber, after the latter has been penetrated by a Wheeler-type knife, in order to force the sclera, choroid, and retina into apposition. This bubble of air helps restore the eye to normal tension. A 3-percent solution of atropine

is instilled, and both eyes are covered. Convalescent treatment includes bed rest for two weeks and the wearing of pin-hole spectacles for three to four months.

Eighteen eyes, all considered inoperable by the usual methods, were operated upon. Ten of these had been operated on before; 10 were aphakic; three required a second operation. The results were classified on the basis of the degree of reattachment and final vision in relation to the preoperatively estimated *possible* vision (judging by the retinal status; that is, macular damage, hemorrhage). In seven cases the cure was complete; in seven, three-quarters or more reattachment was effected with one-half to three-fourths the possible vision; in three, there was one-quarter to one-half reattachment with one-fourth possible vision; one was a failure.

Myopia was reduced as a result of the operation.

This operation is much less radical than are those previously employed. It is hoped that its adoption, along with the use of the simplifying instruments, will partially solve the problem of retinal separation.

OCULAR DRAINAGE

DR. M. URIBE TRONCOSO opened his address with a brief review of the theories advanced to explain the outflow of the aqueous from the anterior chamber. He mentioned Leber's idea of a continuous current of fluid through Schlemm's canal as well as the theory of dialyzation of the aqueous directly through the blood vessels by an intermittent outflow, a theory which was adopted in part by Duke-Elder. Drs. Troncoso, Friedenwald, and Pierce denied the dialyzation theory and showed that a continuous, although slow, current of aqueous runs out of the chamber angle. Dr. Troncoso estimated that the rate of outflow was about 2 c.c. per

minute, and Drs. Friedenwald and Pierce considered it no larger than 1 to 1.5 c.c. per minute.

The majority of authors who have experimented with animal eyes have stated that the mechanism of the liquid outflow is the same as that in man. The absorption of aqueous is made by osmotic and hydrostatic pressure through the barrier of the vessel walls (blood-aqueous barrier). By detailed study of the comparative anatomy of the angle of the anterior chamber in Mammalia, Dr. Troncoso has shown that there is no Schlemm's canal in the lower Mammalia and that aqueous is absorbed directly through the trabecular veins, which are the superficial branches of the intrascleral venous plexus. In the Primates, Schlemm's canal appears as a distinct anatomic landmark. Its inner wall is covered by the trabeculum, and the aqueous is absorbed directly through it into its lumen. Gonioscopy has shown that, in the living eye, Schlemm's canal is filled, not with blood, but with transparent fluid, the aqueous. However, in pathologic conditions, blood may be seen streaming inside the lumen. This change can also be brought about by tapping the anterior chamber, as Kronfeld and McGarry have demonstrated. Dr. Troncoso believes that, contrary to what happens in the lower Mammalia, in Primates (monkey and man) there is no blood-aqueous barrier, but the aqueous is absorbed directly into Schlemm's canal and from it trickles constantly into the blood stream, without the interposition of a vascular wall.

THE EFFECTS OF RADIATION ON THE EYE

DR. ALGERNON B. REESE said that cataract, the most serious complication from irradiation, starts subcapsularly at the posterior pole and usually remains stationary, with surprisingly good vision. Even when dense, the vision may be

20/30. If the lesion progresses, changes appear insidiously under the anterior capsule, usually two to four years after exposure. Eventually, the lens becomes totally opaque.

The histologic change is necrosis and proliferation of the lens epithelium which produce malformed lens cells and metaplastic fibrous tissue under the posterior and anterior capsule.

Any dose of irradiation capable of producing a therapeutic effect can also result in cataract, if the lens is exposed. No measures, even when expertly applied, can give absolute assurance of adequate protection to the eye. Less than one skin-erythema dose produces a cataract. This is less than the amount needed to produce epilation of the cilia. A dose which will induce no immediate effect (such as conjunctivitis, irritation, or demonstrable changes in the eye) may produce a cataract. Even the spilling from the X-ray tube in treatment of carcinoma of the breast, mouth, and neck, may have this effect on the lens.

A radiation cataract seems less likely to develop in younger than in older people. In the treatment of retinoblastoma, we give 8,000 r at each of two portals, and cataract is a rare occurrence.

If the changes progress sufficiently, surgery is indicated for the treatment of radiation cataract. An intracapsular extraction is definitely preferred, for in extracapsular extraction, the lens epithelium continues to proliferate and form metaplastic, fibrous tissue in the anterior chamber.

Irradiation tends to keratinize epithelium. Keratinization of the corneal epithelium may be particularly annoying. It may occur even following moderate doses of irradiation. In its early stages, this keratinization appears as numerous punctate areas, staining with fluorescein, and may develop into an actual vascularized

pannus. Since the patient is usually directed to close the eyes, these changes are confined to the lower portion of the cornea. When keratinization takes place along the lid margin, it is seen as an extension of a gray line to the posterior margin of the lid or on to the palpebral conjunctiva.

Among the other irradiation effects are: (1) trichiasis, loss of cilia, and regrowth of white cilia; (2) atrophy of the tarsus which, perhaps, accounts for the widening of the palpebral aperture sometimes seen on the side exposed to irradiation; (3) disappearance of the firm elastic tissue along the lid margin, which becomes quite soft and pliable; (4) glaucoma, apparently due to an iridocyclitis rather than stoppage of the trabecular spaces with pigment granules, as sometimes stated; (5) proliferation and migration of the pigmented epithelium of the iris, especially over the lower half (seen as an increase in the number of the clump cells, the appearance of pigment dust over the surface of the iris, and the appearance of pigment deposits on the posterior surface of the cornea); (6) atrophy of the pigmented epithelium of the iris (especially around the pupillary margin and over the posterior surface of the iris in its lower half), permitting light to pass through readily; (7) atrophy of a sector of the iris stroma; (8) later, from six months to two years following the irradiation, vascular phenomena in the retina, such as occlusion of an arteriole or of a vein, the appearance of hard, white deposits, and hemorrhages.

As a result of very heavy irradiation, the central portion of the cornea, or a portion of the sclera (if the focus of the irradiation has been directed over it) may become necrotic and act as a sequestrum. Heavy irradiation may cause necrosis of the conjunctiva, which leads to shrinkage and adhesions between the lids and the

globe, sometimes producing total symblepharon.

In conclusion, three cases of bilateral retinoblastoma, with enucleation of the eye with the more advanced stage and irradiation of the other eye, were reported. In these cases, the heavy X-ray therapy precipitated a malignant neoplasm after arresting the original tumor. In one case, after the patient had had normal vision for eight years, a rhabdomyosarcoma of the temporal muscle developed over the site of a portal for the administration of the irradiation of the eye. This tumor proved to be fatal. At necropsy, it was found that the retinoblastoma, for which the irradiation had been given, was completely arrested. The microscopic examination of the retinal lesion showed tumor cells which did not look necrotic; apparently, however, these cells had lost their power to proliferate and remained in a suspended state of viability following the irradiation. Another patient developed a malignant tumor that also proved fatal to the tissues in the pathway of the heavy irradiation of the eye. A biopsy specimen was taken, but the tissue was necrotic, and the type of the secondary growth was not determined. The third case, seen by Dr. Mark Schoenberg, in 1916, was not subjected to the bilateral enucleation customary at that time, but after enucleation of the eye with the more advanced lesion the patient was sent to Memorial Hospital for treatment by irradiation. The retinoblastoma was successfully arrested, and the patient had 20/30 vision for 27 years. In 1943, a tumor appeared in the temporal region over the site of a portal of treatment. This tumor grew rapidly and proved fatal in July, 1944. The pathologic diagnosis was postirradiation scar-tissue sarcoma.

Irradiation of the region of the eye is never indicated unless the condition for

which it is given is serious enough to justify a treatment that always may jeopardize the eye.

PUPILLOGRAPHY IN THE EARLY DIAGNOSIS OF CHRONIC SIMPLE GLAUCOMA

DR. OTTO LOWENSTEIN said that Mark Schoenberg's last great scientific love was pupillography in connection with the problems of simple glaucoma. In 1941, when they had first investigated the early signs of glaucoma, they thought there might be characteristic pupillographic changes prior to the clinical appearance of manifest symptoms. These might shed light on a nervous factor in the origin of simple glaucoma and simultaneously establish a basis for the diagnosis at a preclinical stage. The studies consisted of following, pupillographically, cases of simple glaucoma and trying to discover whether or not a parallelism existed between consecutive stages of the disease and pupillary disturbances.

A short time previously, Dr. Schoenberg had reclassified simple glaucoma into: (1) a functional spontaneous reversible stage; (2) a predominantly functional stage with slight organic changes; (3) a predominantly organic stage; and (4) the completely organic stage.

It was found that on the basis of pupillography, a purely functional stage does not exist, there being permanent pupillary changes when the clinical symptoms still appear to be functional and spontaneously reversible. In every case these changes showed typical characteristics, differing only in degree, and thereby revealing parallelism with the general development of the disease.

Originally it was believed that these pupillary abnormalities were the expression of destruction caused locally in the iris by the increased intraocular pressure. However, it was found that no cases

of unilateral glaucoma exist in which the seemingly unaffected eye does not show deviations from normalcy on the basis of pupillographic examination.

In previous research, Dr. Lowenstein tried to show how disturbances of pupillary movements in otherwise normal eyes are located either in the sympathetic or parasympathetic centers or pathways. A certain number of symptoms were found to be characteristic of disturbances in part of either the sympathetic or parasympathetic centers.

It was found that certain sympathetic disturbances were present in all of 50 cases of simple glaucoma and that these disturbances, in cases of unilateral glaucoma, included the seemingly unaffected eye. These disturbances could be detected in a very early, preclinical stage of the disease, thus making an early diagnosis possible in otherwise dubious cases. These findings led to the assumption of an at least partly central sympathetic origin of noncongestive simple glaucoma. Demonstrably increased intraocular pressure was shown to be preceded by centrally conditioned pupillary disturbances.

The practical question as to whether or not we may base the diagnosis of simple glaucoma exclusively on pupillographic findings of a central nervous, particularly hypothalamic, type must be answered in the negative. However, where there are clinical ophthalmologic reasons for suspecting the development of simple glaucoma, the absence of central sympathetic disturbances of the type described in cases of simple glaucoma excludes the possibility of glaucoma, whereas their presence makes it likely, although not positive.

Mark Schoenberg died before this work on glaucoma was finished, and pupillographic glaucoma-research work lost its most zealous pioneer and champion.

However, the work is being continued.

Discussion. Dr. Bernard Samuels said he once remarked to Dr. Schoenberg that glaucoma like the poor will always be with us. Dr. Schoenberg's characteristic response was that we must do something against it. Whenever he saw anything that was evil, his first reaction was to attempt in some way to alleviate or get rid of it.

Dr. Schoenberg realized that, in the regular meeting of the Section of Ophthalmology of the New York Academy of Medicine, time and opportunity were often lacking for many young men to show their cases and have them discussed. It is just this need which this Clinical Society, founded and organized by him, so admirably fulfills.

In the last years of Dr. Schoenberg's life he found exactly the proper niche for his talents and aspirations in the National Society for the Prevention of Blindness. Up to that time, he had done a great deal in trying to find out the cause of glaucoma.

The papers on glaucoma presented at this meeting bring to mind a condition that is often referred to as malignant postoperative glaucoma. An eye that has suffered from glaucoma simplex, shortly after an operation of whatever kind, may go into a state of inflammatory glaucoma. The anterior chamber is shallow or abolished; the wound gapes a little; the tension is harder than before; the eye is red and painful and goes on to blindness.

Clinically, this type of malignant glaucoma is generally thought to be due to a subchoroidal hemorrhage, that has not gone so far as to produce a typical expulsive hemorrhage. Microscopically, however, these eyes as a rule show no subchoroidal hemorrhage, but they do give evidence of a swollen vitreous. The vitreous is pushed forward in the circumlental space, the ciliary processes are com-

pressed and directed forward. This swelling of the vitreous would seem to show that it possesses certain biologic qualities of reaction to stimuli although it possesses no nuclei.

MARK J. SCHOENBERG—AN APPRECIATION

ELEANOR BROWN MERRILL closed the meeting with a tribute to Dr. Schoenberg and a description of his achievements as the chairman of the Committee on Glaucoma of the National Society for the Prevention of Blindness.

Leon H. Ehrlich,
Secretary.

MEMPHIS SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

October 9, 1945

DR. J. WESLEY MCKINNEY, *presiding*

OLD FOREIGN BODY OF THE IRIS

DR. PHILLIP MERIWETHER LEWIS reported a case of a white man, aged 77 years, seen in August, 1945. In 1890, 55 years ago, while working with brass at his trade of machinist, a piece of metal struck him in his right eye. He was seen by an ophthalmologist, who told him that the brass particle had entered his eye and was embedded in the iris. He was advised to leave it alone. Examination showed an almost completely encapsulated metallic foreign body on the anterior surface of the iris near the pupillary border in the superior-temporal quadrant. The foreign body was apparently slightly more than 1 mm. in diameter. The iris in the immediate vicinity was slightly atrophic, but the pupil reacted normally, and no other abnormality of the eye was present. With a +0.25D sph. \ominus +2.00D. cyl. ax. 180° vision was 20/20. With a +2.50D. sph.

in addition he could read J1. The left eye was normal externally, but there was a senile degeneration of the macula, and vision could not be improved more than 20/200. Neither eye had ever been inflamed or given any trouble since the accident, 55 years before. The patient still worked regularly as a machinist.

TENONITIS COMPLICATING MUMPS

DR. PHILIP MERIWETHER LEWIS reported the case of a white man, aged 34 years, seen six months previously. Both eyes had been quite red and sore for two days. No pus nor mucus was present. There was marked congestion and edema of both eyes, with limitation of motion and marked tenderness. It was noticed that his face was swollen, and examination disclosed that all of his salivary glands on both sides were swollen and tender on palpation. He was thought to have a bilateral tenonitis complicating an acute infection of the salivary glands. His physician considered him to have mumps. He was treated with hot compresses to the eyes and sulfonamides internally. After about eight days his eyes appeared normal except for a slight scleral congestion. It was then noticed for the first time that the tension seemed elevated. Measurement showed it to be O.D., 35 mm., and O.S., 40 mm. Hg (Schiotz). There was no evidence of uveitis.

The regular use of miotics had maintained the pressure at about 30 mm. The peripheral fields had remained normal, but the blind spots were slightly enlarged below. The discs have shown no cupping to this date. Apparently the glaucoma was primary. However, might it not be related, or secondary, to the previous acute condition?

CHICAGO OPHTHALMOLOGICAL
SOCIETY

October 15, 1945

PETER C. KRONFELD, *president*

CLINICAL MEETING

(Presented by the Department of Ophthalmology, Northwestern University Medical School.)

PRIMARY OPTIC ATROPHY POSSIBLY DUE
TO ARACHNOIDITIS

DR. HELEN HOLT presented C. J., aged 60 years, who had experienced progressive loss of vision until he was unable to work, in 1932. Antisyphilitic treatment had been given elsewhere; blood and spinal-fluid tests gave negative results when the patient was admitted to Montgomery Ward Clinic. On examination, visual acuity was R.E. 8/200; L.E. 4/200, and could not be improved. Argyll Robertson pupils were noted. The discs were white, with sharp margins, but the cribriform plate was not visible. When a large target was used, a visual field was demonstrated to be present on the nasal side of each eye, with constriction above. This field and the appearance of the disc suggested a syphilitic arachnoiditis at the chiasm as the etiologic factor. Operation was not indicated at present. The patient was presented to emphasize the necessity of recognizing the condition early to insure preservation of useful vision.

CEREBRAL THROMBOANGIITIS OBLITERANS

DR. HELEN HOLT presented two patients on whom this diagnosis had been made. Mrs. DeP., aged 52 years, had had encephalitis complicating typhoid fever at the age of 19 years. Since 1935 she had been subject to convulsive seizures with loss of consciousness. Encephalograms showed cortical atrophy, especially frontal and occipital. Mild peripheral vasospasm with no evidence of obliterative disease, was found. The blood pressure

was 164/102. Visual acuity was 20/20; external examination was negative. The retinal vessels showed early arteriosclerotic changes. In addition there had been thrombosis of the superior temporal artery with formation of new vessels just above the macular area. The retina supplied by this vessel was atrophic, with pigment irregularity. The patient illustrates retinal thromboangiitis obliterans with cerebral thromboangiitis obliterans.

Mrs. V., aged 41 years, had what had been diagnosed in retrospect as encephalitis complicating la grippe or influenza in 1942. During convalescence the patient was annoyed by a transient diplopia, but not much paresis could be demonstrated. In January, 1943, a violent headache was followed by aphasia, numbness of the left side of the face and left arm, lasting about one-half hour. Personality difficulties were a constant trial, for she could not adopt an adult status toward her home problems. Psychiatric consultation was of only moderate help. In January, 1945, accommodative ability was lost following a severe headache. Three weeks later alexia for words but not numbers suddenly appeared and has persisted, and a right homonymous hemianopia developed. Peripheral vascular spasm was noted on testing. The encephalogram showed cortical atrophy. A preoperative diagnosis of cerebral thromboangiitis obliterans was made and was confirmed by Dr. Loyal Davis when a right osteoplastic craniotomy was performed. Visual acuity continues to be 20/15. The retinal vessels show no abnormalities. This patient illustrates marked peripheral vasospasm, cerebral thromboangiitis obliterans, with considerable cerebral atrophy and no ocular involvement.

ARACHNOIDITIS

DR. HELEN HOLT said that Mr. J. A. had been presented before this group sev-

eral years ago. In 1936 he had been successfully operated on for a nonspecific arachnoiditis and was presented now to show that visual acuity and peripheral fields are maintained after surgical correction of the constricting bands.

RETINOBLASTOMA

DR. HELEN HOLT said that Sandra R., aged 4 years, had undergone an enucleation of the left eye at the age of 18 months because of a retinoblastoma which filled the vitreous cavity. Tumor masses were noted in the right eye. Seven days after the enucleation, September 15, 1942, intensive X-ray therapy was given to the right eye through the temple region and left border of the nose, according to the standards set up by Dr. Reese. Within the next six months a total of 19,800 r was given. The tumor masses flattened and were replaced by shiny white tissue. On the last fundus examination, May 18, 1945, the lenses were clear; no active tumor tissue was visible. No accurate visual acuity could be obtained, but the child seemed to play normally. Her general status has improved remarkably. The prognosis as to life is good and for useful vision fair.

ARTERIOSCLEROTIC RETINOPATHY COMPLICATING CATARACT

DR. HELEN HOLT said that Mrs. H., aged 65 years, had been a known diabetic for 12 years. On admission her blood pressure was 154/90, blood sugar 384. Diabetic management was instituted. Visual acuity was light perception and projection in each eye. Posterior findings were obscured by mature senile cataract. When the diabetes was controlled, intracapsular cataract extraction was performed on the left eye on December 21st, on the right on January 6th. The postoperative course was uneventful. Visual acuity could not be improved above

10/200. In the fundus of the right eye a delicate gray tissue extended into the vitreous in front of the macula, and the macular area was replaced by a yellow atrophic spot with pigmented borders; in the left eye there was a round atrophic spot in the macula about one-fourth disc diameter in size, with a pigment border; just temporal to this was another patch with a pigment band joining the two. Since then, the arteries of the right eye have become almost imperceptible, and the arteriosclerotic changes are becoming more marked. Gradual closure of the central artery seems to be in process.

TAPETO-RETINAL DEGENERATION

DR. HELEN HOLT said that D. R., a woman aged 29 years, had been presented before this Society in 1939 and 1941 as a case of retinal angiospasm with progressive retinal degeneration. Now the pigmentary changes in the periphery of the retina and the macula with secondary partial optic atrophy, narrowed arteries, and nystagmus, tend to place this case in the category of tapeto-retinal degenerative lesions.

PARINAUD'S CONJUNCTIVITIS

DR. PAULSON said that Miguel, aged 11, had a red left eye with tearing, little purulent discharge, and pain. When examined, the conjunctivas of both lids and globe were velvety red and thickened. The cornea was clear. A diagnosis of conjunctivitis was made, and sulfathiazole was prescribed for local use. The smears were negative. Two days later the eye was slightly improved but the bulbar conjunctiva had a mottled yellow-red appearance with swelling more noticeable on the temporal side. Smears and cultures were negative. Two days later, the temporal area was pointing, and the preauricular gland was enlarged. The patient was hos-

pitalized in Cook County Hospital, the pointing area was incised, and cultures made, which proved to be leptothrix. Recovery was complete following the local and systemic use of sulfa drugs.

ALLERGIC KERATITIS AND IRITIS

Mrs. K., aged 30 years, had suffered from recurrent attacks of keratitis and iritis and was seen at the Montgomery Ward Clinic in the spring of 1944, during an acute attack of iritis. She was hospitalized for clinical study and foreign-protein therapy. No focus of infection was found, and no irritant was proved by allergy tests. Elsewhere it was demonstrated that she was sensitive to peanuts, and she realized that indulgence in this food always precipitated attacks. The patient was not seen for more than a year, but has suffered recurrent attacks which have subsided spontaneously. At present, examination shows many faint macular scars in the cornea from attacks of keratitis. More careful allergy studies should be made, and treatment given to prevent further ocular damage.

CHORIORETINITIS

DR. IRVING PUNTENNEY said that Mrs. D., aged 51 years, was examined in 1943, when the vision was found to be 20/50 in the R.E. Recently, there had been a diminution to 20/200. The patient had not been aware of any visual difficulty and had had no illness. On examination, a dense gray film of tissue was found beneath the retinal vessels and above the choroid in an area above the disc, extending around on the temporal side for a distance of 0.5 disc diameter. The macular area was atrophic and granular. No evidence of perivascularitis was noted. The left eye was normal. This patient had previously been treated for syphilis, but for several years tests had been negative. Since this lesion was entirely healed at the time of examination, no further study was made. The similarity of the old lesion to an active one produced by Brucellosis in a private patient examined on the same day prompted presentation of this case. Consideration of Brucellosis as a cause of chorioretinitis should not be overlooked.

R. Von der Heydt.

AMERICAN JOURNAL OF OPHTHALMOLOGY

Published Monthly by the Ophthalmic Publishing Company

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EMMA S. BUSS (1887-1946)

It is with heavy heart that the Journal notes the death of its distinguished and loved manuscript editor, Miss Emma S. Buss. She died quietly in sleep at twilight on August 18, 1946, of cerebral embolism that had swiftly cut her down on the preceding day, in full activity.

Miss Buss came to the Journal as manu-

script editor, fully qualified for this meticulous task by a fine training in the preparation of literary and scientific manuscripts. Her knowledge of and interest in the art of written English had great influence upon the literary style of many contributors to the Journal, particularly among the younger authors whose first ventures invariably received her special sympathetic and tactful treatment.

Restricted in her activities by delicate

health and physical handicap, she devoted her life to her religion and to the Journal. These were her two loves and in them she found happiness and satisfaction. The pages of this Journal for the last 15 years reflect her painstaking care and affection. They are the true monument to her memory and tributes to her skill and devotion.

To many she was but a kindly, often uncompromising name. To those who were her coworkers she was a vibrant personality, jealous of the Journal's prestige, a stickler for style, form, balance, and always the right word. Her knowledge of Ophthalmology absorbed from these many years of painstaking work and extensive reading was truly remarkable. One could safely count on her to pounce upon an error in ophthalmic information as well as one in verbal expression.

She looked upon the contributors as her own people and members of the family. She appreciated news of their activities and items of personal interest. She followed their careers with maternal eye, rejoicing in their success and grieving over the lost ones. This is all the more striking because she had met few of them in person. To her they were very real men and women and her friends.

Ophthalmology has lost a staunch champion of great integrity, ophthalmic literature a gentle puritan, and the Journal its right hand. We salute and honor this gracious Christian lady.

Derrick Vail.

OPHTHALMOLOGY IN THE VETERANS' ADMINISTRATION

Almost any magazine that one picks up nowadays is apt to contain an article about the Veterans' Administration. Gratifyingly, the tone of these is changing. Whereas a year or more ago, most of them were condemnatory, the later ones are usually laudatory. This is largely due

to the attitude of the new director, Gen. Omar Bradley, and of Gen. Paul R. Hawley in the medical field. The main idea is to give effective service to the veteran without overconsideration for previous rules and regulations. The medical profession was at first very dubious about the whole business, fearing socialization and state medicine, but since the doctors are pretty well satisfied now that this is not in the back of General Hawley's mind and that he is eager for constructive criticism and wants to allow the doctors themselves to have a voice in the planning and in many instances will permit the veteran to choose his own doctor, they have begun to swing into line, praising the efforts of the Veterans' Administration to do a good job.

Let us glance at the overall plans for medical care and then at some details about the ophthalmologic needs and how they are being met.

For administrative purposes the nation has been divided into 13 areas. A supreme consultant has been placed in charge of each branch of medicine, under whom are 13 senior consultants, one in each area. In most areas there are about eight veterans' hospitals—slightly more than 100 in all.

Employment of physicians may be on several different time bases; as, for example, on full time. In the ninth area, the ophthalmologists on this status were also doing otolaryngology when these hospitals were visited in May of this year. The few of these who were employed were mostly young men who were inadequately trained because specialty training has not previously been available to many, owing to the lack of facilities for giving this type of instruction. Also, there are no replacements for those men who wish to take courses elsewhere than at their own posts, as they are now permitted to do. These full-time men are most important

to the hospitals because they are always available and can afford to give unstintingly of their time.

Consultants on part-time—presumably mostly on half-time—service have proved important in the set up. They are usually older than the full-time eye specialists and have more experience. Many are certificated by their Boards and have had considerable surgical training. There are definite drawbacks to this form of service, however, in cases where the responsibility for the conduct of the specialty rests solely on these part-time men. To attract these older men it has been necessary to allow them such salaries that dissatisfaction has been occasioned in the full-time group. Their salaries have approached those of the full-time men, and they have had the further advantage of having half time in which to build and carry on a private practice. Often they have had to perform the functions of full-time men because of lack of the latter. If they are to be employed at all, their function should be primarily as instructors to the young men in the full-time appointments, most of whom will have the status of residents. They should supervise systematic courses of instruction, where basic courses in medical schools are not available, covering most of the phases of ophthalmology as well as giving the help usually expected of a consultant, such as advice and surgical assistance.

A third type of helper is the ophthalmologist retained on a fee basis. This physician functions in either or both of two ways; first, by seeing such patients as are sent to his private office from the regional offices and for which consultations he is paid by the visit (these offices usually represent the veterans' non-hospital centers in the area); or second, by making visits to a veterans' hospital on request.

A recent tour of the veterans' hospitals

in the ninth area—Missouri, Kansas, Oklahoma, and Arkansas—gave a picture of all of these methods. In passing, a word might be said commending the foresight of whoever selected the sites of these hospitals and designed the hospitals. Invariably they are located in the highest part of a city or town, in commanding situations with beautiful views. The buildings are, for the most part, modern, well-designed, and well-equipped, although a few are modernized old army-post hospitals. It might also be added that the administrators and chiefs of the medical services give an impression of real interest in their work and of a high grade of efficiency. They seem so keen for the new order that one would have thought that it had originated in the minds of each or at least was just what they had been awaiting through the years. There is, however, some uncertainty as to how much authority each element has in the organization: the dean's committees, the managers, and the branch consultants. The arrangements are all new, and these matters will have to be worked out gradually.

But to return to the methods of employment, in only two of the eight hospitals was there a full-time ophthalmologist and otolaryngologist, and in none a full-time ophthalmologist. Everywhere the former at least was badly needed. This man should be the one doing the major part of the ophthalmology. Instead, his work was usually being done less effectively by one or more consultants whose visits to the hospitals were often intermittent, somewhat casual, and sometimes at the convenience of the consultant rather than at that of the hospital.

Primarily, this would seem to be because the young men who would be desirable for the full-time service have not been interested. One may ask why this is so. In the first place the Veterans' Ad-

ministration has been disparaged by physicians and laymen. One of the most important services that the many new consultants can do for the Veterans' Administration is to talk it "up," not "down." Broadcast the good name that it now deserves, and also, of course, make it a better place for training young men.

This introduces the next point: training. The young man wants to go into a residency where he will get good instruction, a residency so good that it will be accepted for training by the American Boards. Can the Veterans' Administration put on this kind of a program for its young men? In certain of the hospitals this might be done in the following manner. In the first place veterans' hospitals wherever possible should be closely integrated with medical schools. Where graduate training is already being given in these schools, arrangements could be made for the veterans' hospital residents to attend the lectures. Where such programs have not been set up, it might be possible to conduct correspondence courses from medical schools in the area, utilizing the local consultants as advisers in these courses. A stimulating addition to this would be to permit the young residents occasionally to attend one of the recognized basic courses for a week or so at a time. Some of the organizations giving basic training have scheduled their lectures so that they could be handled in this manner. In those areas where no such courses are given, the correspondence courses of the American Academy of Ophthalmology and Otolaryngology might be utilized. The coöperation of the consultants in a teaching capacity is a *sine qua non* for the successful accomplishment of this project.

If some such plans as this, which might lead to complete training for Board examinations, were offered as an attraction, it is likely that there would not be too

great difficulty in signing up residents. But this should be done at once while there are so many veterans seeking specialty training. Since the salaries of veterans' hospital medical personnel are automatically raised 25 percent upon their obtaining certificates of their Boards, it is probable that this would serve as an inducement for them to take permanent positions with the Veterans' Administration.

Lawrence T. Post.

THE ASSOCIATION FOR RESEARCH IN OPHTHALMOLOGY

The fifteenth scientific meeting of the Association for Research in Ophthalmology was held in the Hotel Mark Hopkins Tuesday, July 2d. Eight papers on experimental ophthalmology were presented on subjects varying from experimental dinitrophenol cataract to observations on the aqueous veins. The meeting was well attended and constituted a valuable supplement to the programs of the American Ophthalmological Society which preceded it and of the Section on Ophthalmology of the American Medical Association which followed it. In its 15 years of existence the Association has proved to be a very valuable outlet for ophthalmological research of the more basic type and has brought to the attention of the clinical ophthalmologist many basic studies which might otherwise, in large part at least, have been lost to him in the basic science journals. The Association has drawn together the clinical ophthalmologists especially interested in basic research and the not inconsiderable number of basic science investigators attached to the various university eye departments throughout the country.

In their meeting this year the trustees of the Association decided to take steps which would enable the Association to

function in this direction even more extensively than in the past. It was felt that the Association should be the main meeting ground for the clinical ophthalmologist and the basic science workers engaged with eye problems, including those *not* attached to eye departments. It was pointed out that there are a surprising number of studies of eye interest being performed by anatomists, physiologists, biochemists, microbiologists, geneticists, and other workers in the basic sciences which in general only reach ophthalmologists indirectly in the form of cursory reviews in the abstract sections of our journals.

To encourage these workers to present their papers to the Association, steps were taken to broaden the membership by reducing the membership fees of full-time research workers in the basic sciences and by arranging for the appointment of an increasing number of outstanding basic-science workers to the offices of the Association. It was agreed further that the Association should create a research medal, comparable to the Howe Medal of the American Ophthalmological Society, to be awarded for basic studies of special value. With a view to increasing the availability of basic studies of eye significance to ophthalmologists in general, a committee was appointed to investigate the possibility of developing special basic-science supplements to the established journals to contain comprehensive abstracts or complete articles. The committee is even to consider the eventual publication of an independent journal of investigative ophthalmology.

In a broad sense there are two types of basic research in ophthalmology. The first may be termed original research and is the type requiring the rarer talent. The second type, also of great value, consists in the application to special eye

problems of the tremendous amount of original basic research done by investigators in the various basic fields. This may be compared with the work of the industrial scientist who makes practical application of the discoveries of the pure research worker to special industrial problems. Progress in ophthalmology, as in other specialties, must follow, in large part at least, the progress of basic scientific research, and a primary purpose of the Association for Research is to foster such research and to bring its results to bear as fully as possible on the problems of ophthalmology. It is a great credit to the profession that so many ophthalmologists have recognized the importance of this relationship and that the founders of this Association had the vision to organize a society to promote it.

Phillips Thygeson

RETURN LEND-LEASE

At the close of one of the San Francisco meetings, the members were still delighting in the felicitous remarks of a distinguished British guest. This was not alone for the gracious and easy phrasing, but even more by reason of the precise and interesting choice of words. Perhaps no one realized that singling out this speech was no compliment to the other speakers on the program. This is not the first time that the superior flavor of English medical papers has been noticed.

Very likely this is only another evidence of American adolescence but the time is not too distant when we should be outgrowing our more glaring faults of style, either slovenly, on the one hand, or pretentious on the other. At the same session someone privately criticized the repeated references to "recti muscles." This queer barbarism seems to have caught the fancy of a number of recent speakers. This may be simply struggling

for elegance, or it may be that these authors are overcome by the knowledge that however disagreeable the Romans themselves may have been, they saw to it that their adjectives conformed in number and case to the antecedent nouns. At any rate, some men who would never have been caught saying "obliques muscles" go all out for pluralizing "rectus." So it was "recti muscles," as we say in the Latin.

This is nothing, though, to the French influence. By it Professor Barraquer is deprived of the final "r" of the Spanish, and is Gallicized to "Bar-ra-kay." H. M. Traquar ceases to be Scotch and becomes "Tra-care." Even when the Greeks had a perfectly good word we still have to show off our French. Ophthalmic residents who would never be guilty of pronouncing "shemosis" for chemosis, speak glibly of "shalazion" meaning chalazion. Yet when we could follow the French to advantage, we have to use the Greek derivative to our everlasting sorrow. In the dear dead days you had your eyes examined by an oculist. This was standard procedure. The public was familiar with the word ocular as an adjective, and as the eyepiece of an optical instrument. So there was no uncertainty as to the occupation of an oculist. Today we are ophthalmologists, but what layman knows what ophthalmologist means? This is beside the point in discussing diction, but just how long did it take your secretary to learn to spell the name of your occupation correctly—if she can do it now? Years ago, when oculists were beginning to go out of circulation, one of the journals carried a long paper advocating instead, the use of "ophthalmologist." Uniformity, it said, demands

it. Well, we have achieved uniformity. We stand on the same rarefied plane as the otologists and the rhinologists, names which carry no glimmer of significance to the public. To be sure we might have dropped to the level of the pediatricists, who are popularly confused with corn-doctors. "I know that opto-MEET-rists fit eyes, but what," asked a lovely blonde thing, "is an ophthal-MO-gist?"

This brings up a little clean fun enjoyed by one of the elder statesmen, at the expense of ophthalmologists who use the optometric term "duction," for convergence and divergence. A much neater trick of our lay confreres has been to foist upon us the abuse of "pathology." This is not in the proper abstract sense of the science, or study, but to signify the concrete lesion. "There is no pathology," they say, meaning that no abnormality is noted. Why not say there is no ophthalmology and have done with it. Pathology sounds more rococo, which is reason enough for avoiding it.

If the mischief worked by the radio were to be discussed, there would be no end to this plaint. It would be a comfort, though, to go to just one meeting without hearing someone say "different than" when meaning "different from," or having the ears assailed by the penultimate accentuation, "posi-TIVE-ly" and "evidENT-ly" after the jargon of the announcers.

How about going British enough to act as though we had had an ordinary grammar school education?

They have several things over there to contribute besides island bases.

S. Judd Beach.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

- | | |
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| 1. General methods of diagnosis | 10. Retina and vitreous |
| 2. Therapeutics and operations | 11. Optic nerve and toxic amblyopias |
| 3. Physiologic optics, refraction, and color vision | 12. Visual tracts and centers |
| 4. Ocular movements | 13. Eyeball and orbit |
| 5. Conjunctiva | 14. Eyelids and lacrimal apparatus |
| 6. Cornea and sclera | 15. Tumors |
| 7. Uveal tract, sympathetic disease, and aqueous humor | 16. Injuries |
| 8. Glaucoma and ocular tension | 17. Systemic diseases and parasites |
| 9. Crystalline lens | 18. Hygiene, sociology, education, and history |
| | 19. Anatomy, embryology, and comparative ophthalmology |

6

CORNEA AND SCLERA

Pillat, A. The incidence of epidemic keratoconjunctivitis in Styria. *Klin. M. f. Augenh.*, 1943, v. 109, May-June, p. 289.

Pillat reports his observation in 160 cases of epidemic keratoconjunctivitis observed in the University Eye Hospital at Graz during the severe epidemic of 1942. The highest peak was reached in February and a minor elevation in June. In 40 percent of the cases the conjunctiva alone was affected and in 60 percent both conjunctiva and cornea. The diagnosis may be questioned when the process is confined to the conjunctiva, since the disease may be confounded with other diseases such as trachoma, follicular conjunctivitis, and even tularemia. As a matter of fact 27 of the 160 patients had suffered from various eye diseases before the outbreak of the keratoconjunctivitis. In 13 patients trauma had preceded the onset of the inflammation, and in 10 of these a surgical operation. Temporary loss of vision up to 5/36

was observed in 20 patients, but all regained normal or approximately normal vision after a few weeks. The majority of cases occurred in the young and the middle-aged and predominantly in the urban population. In the post-operative inflammations the infection started at least six to ten days after the operation was performed, and it must be assumed that it was transmitted from one patient to another by doctors, nurses, or dressing material. Acquisition of immunity after healing of the disease is probable. There were no definite recurrences. Experimental inoculation of animal (rabbit and guinea pig) eyes failed. Bacteriologic examinations revealed no pathogenic bacteria. Therapeutically it is important to avoid all kinds of dressings in all stages of the disease. Local treatment consisted of instillations of 3 to 5-percent targesin or 3-percent boric acid solution. Sterile horse serum or liquid paraffin instilled hourly were also beneficial. Pillat does not believe that a 1-percent solution of optochin is as specific as has been claimed. Heat is indicated when the cornea is in-

volved. Pillat has the impression that sulfa drugs in large doses contributed to a more rapid disappearance of the irritation of the cornea as well as of the conjunctiva. He is definitely opposed to the practice of considering the three most common superficial corneal diseases (allergic, superficial, punctate keratitis, epidemic keratoconjunctivitis, and keratoconjunctivitis nummularis) as one. They should be differentiated until the etiologic factors are known. (1 map, 3 charts, 4 corneal pictures, references.) F. Nelson.

Sydenstricker, V. P., Hall, W. K., Hock, C. W., Pund, E. R. **Amino acid and protein deficiencies as causes of corneal vascularization: a preliminary report.** *Science*, 1946, v. 103, Feb. 15, pp. 194-196.

In May, 1945, a biomicroscopic examination was made of more than 200 inhabitants of Leiden, The Netherlands, who were selected at random from the population. Ten percent were suffering from famine edema. None of the individuals examined showed corneal vessels. In the rat corneal vascularization develops when there is a deficiency of any of three indispensable amino acids or of protein. Further investigation is necessary before the significance of these findings becomes clear. (References.)

Melchior Lombardo.

7

UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Beauvieux, J., and Bessière, E. **Sympathetic ophthalmia. Its place in general pathology.** *Presse Médicale*, 1945, no. 44, Nov. 3, p. 593.

The various theories as to the etiology of sympathetic ophthalmia are reviewed. The authors conclude that

the disease must be an infection and note that several clinical observations point to the bloodstream as the source. They report a case of the disease in a man, 61 years of age, who suffered a perforating injury of the left eye which necessitated enucleation 35 days later because of impending sympathetic inflammation of the right eye. With the first signs of irritation in the sympathizing eye the patient noted severe frontal and occipital headaches, partial deafness and humming noises, and evening temperature elevations. Spinal fluid studies showed 543 lymphocytes per cubic millimeter. Treatment consisted of intravenous injections of sodium salicylate and intramuscular injection of electrargol, followed later by a course of penicillin, 630,000 units in eight days. Under treatment the temperature became normal, the headaches and deafness disappeared, and the inflammation of the eye subsided somewhat, although vision had dropped to 0/2. Ophthalmoscopic examination revealed a retinal detachment in the extreme periphery in the lower quadrant of each eye but this subsided spontaneously. Three months after the injury, however, the spinal fluid still showed 400 lymphocytes per cubic millimeter.

The resemblance of this case to Hara-da's disease and to the Vogt-Koyanagi syndrome was striking and the authors conclude that the symptomatic triad of bilateral uveitis, lymphocytic meningitis, and neurologic difficulties belong not only to sympathetic ophthalmia but to other syndromes. They do not believe that this indicates a common etiology but rather that it suggests that different viruses may have similar tissue affinities.

Phillips Thygeson.

Bessiere, E., and Corcelle, L. Uveo-meningitis and Harada's disease. *Arch. d'Ophth.*, 1945, v. 5, no. 3, p. 344.

The authors add two new observations to the literature on the syndrome of bilateral uveitis with meningitic or cerebral manifestations. Neither patient, however, had auditory difficulties, retinal detachment, or pigmentary disturbances of the skin or hair such as are customarily found in Harada's disease. They discuss the nature of this type of uveitis and conclude that Harada's disease is truly a clinical entity but that it is not correct to consider all cases of uveitis with meningeal symptoms as incomplete forms of it. They point out that many of the neurotropic viruses, for example, the herpes zoster virus, may affect both the uveal tract and the central nervous system.

Phillips Thygeson.

Brues, A. M. A genetic analysis of human eye color. *Am. J. Phys. Anthropol.*, 1946, v. 4, March, p. 1.

Comparisons of siblings provide a better basis for studies in human genetics than analyses of successive generations, since the latter method is limited and often dependent on indirect evidence. This paper demonstrates the methodology of sibling comparison studies, as applied to the analysis of human eye color.

Three hundred subjects were examined. Ten color groups were arbitrarily set up, as well as groupings for secondary iris markings. In all, there were 50 possible color combinations, reduced for simplicity to eight eye color types. To this color analysis, there was added the additional variable of iris structure, for which purpose iris patterns were grouped as: smooth or smooth-striated, cryptose, ridged, eroded or scalloped.

The varieties of eye color, with the criteria of iris structure, could be explained, from this study, by six factors:

1. The first factor, a dominant, was a determinant of heavy, dark irides (smooth, brown).

2. The second factor determined differences between dark smooth and brown-mixed smooth irides.

3. The third was the sex-linked "dark" factor. In this connection it was observed that there was a predominance of darker eyes in women.

4. A sex-linked dominant factor was responsible for the antenatal or neonatal vessel atrophy which produced the "scalloped" or "ridged" iris. In the absence of this factor, the irides appeared "cryptose" or "eroded."

5. A fifth factor was that which rendered the pigmented areas, in a "mixed" eye brown, rather than yellow.

6. A recessive factor responsible for the infrequent truly dark eyes without smooth structure.

The importance of iris structure in relation to color inheritance complicates any attempt to systematize the data in this study, and demonstrates the impracticability of attempting to predict eye color in offspring, or to trace parentage through evaluation of eye color. The only practical value of the study may be in the possibility of predicting, on the basis of dominant sex-linked iris traits, whether normal females are carriers of sex-linked defects known to exist in their families.

Benjamin Milder.

Buckler, C. W. Seesaw nystagmus associated with choroiditis and positive neutralization test for toxoplasma. *Arch. of Ophth.*, 1946, v. 35, March, pp. 301-302. (See Section 4, Ocular movements.)

Essen-Möller, Lars. **Pulmonary findings in chronic and acute iridocyclitis and choroiditis.** *Acta Ophth.*, 1942, v. 20, pt. 2, pp. 97-120.

The data are based on pulmonary X-ray findings in 186 cases of chronic iridocyclitis, 140 cases of acute iridocyclitis, 62 cases of sclero-keratitis, and 44 cases of choroiditis. The chest X-ray films of 96 patients hospitalized because of accidents, 325 psychiatric patients, and 21 patients with eye diseases that have no relation to tuberculosis were used as a control. A comparative analysis of the pulmonary findings in the two groups reveals the following facts.

In chronic iridocyclitis active pulmonary processes, mostly at the hilus, were found in about half of the patients, or 10 percent more frequently than in the control group. The pulmonary changes were found chiefly in iridocyclitis with iris nodules and fatty precipitates, findings that clinically suggest tuberculosis or Boeck's sarcoid. The active hilus processes were also apparently of the same origin and could be considered a source of hematogenous infection. There was no greater frequency of active foci or healed scars in the lungs of patients with diseased eyes than in those of the control group.

The frequency of pulmonary lesions, active or healed, in acute iridocyclitis was not greater than in the control group. Clinically, the ocular disease was attributed to rheumatism, gonorrhea, and acute infections.

In sclerokeratitis pulmonary lesions were found with the same frequency as in chronic iridocyclitis; there were scars in the lungs, presumably of tuberculous origin. There was no case of Boeck's sarcoid in this group, and hilus adenitis was found once. The pul-

monary lesions are apparently of a different type from those found in iridocyclitis, and suggest a different pathogenesis. It is particularly interesting that in choroiditis the pulmonary lesions did not exceed those of the control group; hilus adenitis was not found in any of these. Choroiditis is generally believed to be tuberculous, and the lesions in the fundus are believed to be the invasion sites of tubercle bacilli. The data of this study indicate that the relation between choroiditis and tuberculosis needs further investigation.

It is pointed out that the determination of the etiology of the ocular lesions on the basis of pulmonary X-ray findings is not reliable. The tonsils and the cervical and mediastinal glands should be considered as sources of a tuberculous infection. There is also the possibility that pathologic hilus glands and active processes in calcified glands may escape roentgenologic demonstration.
Ray K. Daily.

Essen-Möller, Lars. **The prognosis of chronic iridocyclitis.** *Acta Ophth.*, 1942, v. 20, pt. 2, pp. 121-144.

A detailed analysis of 244 case histories of chronic iridocyclitis revealed that the data were adequate for this study in 86 percent. Seventy-two percent of the patients recovered, and in 42 percent the vision was normal. Forty-two percent had a visual acuity of less than 0.3 and 30 percent were practically blind. Vocational disability between 80 and 100 percent occurred in 20 percent of the patients. The prognosis for recovery and for visual acuity is worse in bilateral lesions. In patients over 40 years of age, the prognosis is poorer for women than for men; in younger patients it is the same in women and men. A rise in ocular ten-

sion occurred in one third of the eyes. A moderate rise of short duration does not affect the prognosis. With a marked and prolonged rise of tension, the prognosis is worse, particularly when surgical intervention becomes necessary.

When pulmonary changes are demonstrable roentgenoscopically the prognosis of the ocular lesion is worse than in patients with normal lungs. The clinical course of the ocular lesion was no different in patients with healed pulmonary lesions than in those with active processes. When there were active lung lesions, the ocular involvement was more frequently bilateral.

Ray K. Daily.

Gonzales-Pola, A. M. The **physiopathology of the intraocular circulation**. Arch. de la Soc. Oft. Hisp.-Amer., 1945, v. 5, Feb., pp. 79-91.

The autonomic-endocrine imbalance and its relation to the uveo-retinal circulation is briefly discussed. With the development of ophthalmoscopy in red light and retino-photography in infra-red light the choroidal circulation, formerly inaccessible for study, will become better understood, and many of the pathologic processes grouped under the common name of choroiditis will be found to be the results of vascular disturbances. The occurrence of choroidal lesions at puberty and at the menopause indicates that the endocrine glands play an important role in their pathogenesis. The organic lesions are secondary to functional disturbances. Because of the abundant blood vessels of the choroid circulatory disturbances do not cause a necrosis of tissue. The primary disturbance is a slowing of the blood stream due to a lack of vascular tone and defective contractility of the vessel wall. The para-

sympathetic function is diminished with an excess of sympathetic dominance; this leads to vascular spasms, an increased pH, and diminished oxygen content; the latter stimulates the vasodilators and an irregular alternation of vaso-constriction and vaso-dilatation sets in which impairs the function of the choroidal vessels and retinal nutrition. Localized disturbances of this nature result in the development of the choroidal foci, which were formerly considered inflammatory.

The therapeutic difficulties are due to the fact that the drugs that affect the general blood pressure have no effect on the retinal vessels, unless administered inträarterially. Whatever effect on the eye may be obtained through the general administration of mimetic drugs can be fortified by the local use of such drugs in the eye.

Ray K. Daily.

Jebejian, R. and Kalfayan, B. The **oculo-bucco-genital syndrome**. Ann. d'Ocul., 1945, v. 178, Aug., pp. 335-344.

Fifteen cases of this syndrome (Behcet) have been reported. There may be recurrent iritis in both eyes and retinal inflammation with hemorrhages and retinitis proliferans. In the lips and mouth recurrent ulcers of the herpetic type occur, and the genital lesions are recurrent ulcers in scrotum and vulva. Erythema nodosum and joint inflammations are less frequent. There is rarely any loss of the general well-being of the patient. Both sexes and practically all ages may be affected. Involvement of the different bodily parts may be mild or severe, complete or incomplete, simultaneous or at intervals. In the author's case, a transient recurrent macular edema in both eyes was first observed in a mechanic, 19 years of age, and apparently in good health.

This was followed by a bilateral iritis with hypopyon, and later by retinal hemorrhages, retinitis proliferans, and ulcers in the lips, mouth, and scrotum. All relevant serological tests were negative. A biopsy from the lip revealed acid fast bacilli resembling those of bovine tuberculosis. In the course of five years the vision of one eye was lost completely because of secondary glaucoma and atrophy. The vision of the other eye was 8/200. This syndrome apparently is a basic constitutional degeneration of definite tissues in several parts of the body, that makes them allergic or reduces their resistance to the organisms or toxins of several bacteria or viruses. (6 figures. 20 references.) Chas. A. Bahn.

Kinsey, V. E., Jackson, B., and Terry, T. L. Development of secretory function of ciliary body in the rabbit eye. *Arch. of Ophth.*, 1945, v. 34, Nov.-Dec., pp. 415-417.

As one approach to the problem of the causation of ocular maldevelopment in premature infants, a study was made to determine when the intraocular fluid assumes its adult character of a secretion. The ascorbic acid content of the aqueous humor and blood were measured in rabbits from birth until the age of 32 days. The concentration in the aqueous was found to increase rapidly after the ninth day, reaching the adult level 18 days later. The ascorbic acid concentration of the blood remained essentially constant. The concentration of ascorbic acid in guinea pigs at birth did not differ significantly from that in the adult animals.

The volume of the aqueous and the volume of the eye increased linearly with age from birth. The ratio of the volume of aqueous to the volume of the

whole eye increased rapidly from birth to reach a constant value at the same time (27 days of age) that the ascorbic acid concentration reached a maximum. John C. Long.

Måhlén, Sven. A contribution to the knowledge of flocculi iridis. *Acta Ophth.*, 1942, v. 20, pt. 2, pp. 153-158.

The literature is reviewed in detail and a case in a 15-year-old boy is reported. There was no relevant family history and his visual acuity was normal. His pupillary borders were surrounded by small brown grape-like bodies, some of which were vesicular. Homatropine produced only moderate mydriasis because the flocculi presented a mechanical obstruction to dilatation. (2 illustrations.)

Ray K. Daily.

Porsaa, Kaj. Papilloedema in iridocyclitis. *Acta Ophth.*, 1944, v. 21, pt. 4, pp. 316-329. (See Section 11, Optic nerve and toxic amblyopias.)

Rasmussen, Knud. Pathologico-anatomic investigation of iritis Boeck. *Acta Ophth.*, 1943, v. 21, pt. 3, p. 214-223.

The enucleated eye of a girl, 12 years of age, presented a microscopic picture of chronic iridocyclitis, that involved principally the ciliary body. The large mass of tissue that adhered to the ciliary body and extended to the lens and choroid consisted of connective tissue with round-cell infiltration, interspersed with larger and smaller conglomerates of typical epithelioid tissue. The literature is reviewed, and it is reaffirmed that clinically and histologically Boeck's uveitis is a special ocular manifestation of a general affection, and not an incidental occurrence of uve-

itis in a patient suffering from Boeck's sarcoid. (4 illustrations.)

Ray K. Daily.

Rauh, Walter. The photographic picture of choroiditis centralis serosa. *Klin. M. f. Augenh.*, 1943, v. 109, March-April, p. 152.

Central serous choroiditis, apparently common in Japan, was thought to be rare in Germany until Meisner pointed out in 1942 that it occurs more commonly than had been assumed. Rauh reports two cases, one of which occurred in a woman, 37 years of age, and the other in a man, 38 years of age. He was able to follow up the increase and decrease of the edematous disc in the macular region and the formation of pigmentation and choroidal foci near the posterior pole with serial fundus photographs. In both cases the characteristic sharp limitations of the edema, the small grayish-yellow spots in the lesion, the development of a choroidal lesion, a slight recurrence, and eventually the total disappearance of the edema could be demonstrated photographically. (13 fundus photographs, references.) F. Nelson.

Rogge, A. J. A case of sympathetic heterochromia acquired in adult age. *Acta Ophth.*, 1942, v. 20, pt. 2, pp. 205-211.

A woman, 49 years of age, developed myosis in the left eye, narrowing of the palpebral fissure, and a partial depigmentation of the iris, which had been normally pigmented. The pupil was displaced slightly nasally. General examination was negative, except for a paralysis of the sympathetic on the left side. The father of the patient had blue and the mother brown eyes. It is believed that this patient had a

latent hereditary predisposition to heterochromia due to incomplete crossing of the hereditary traits from the parents, which became active after paralysis of the sympathetic. The cause of the sympathetic paralysis could not be determined. Ray K. Daily.

8

GLAUCOMA AND OCULAR TENSION

Bailliart, P. Some errors in ophthalmic practice: glaucoma. *Ann. d'Ocul.*, 1945, v. 178, June, pp. 254-257.

The need for frequent changes of glasses in those past 50 years of age, a transient or permanent change in visual acuity, and pain in and about the eyes without objective explanation should suggest tonometry and field measurements. Clinical glaucoma with practically normal tension is easily overlooked. Pilocarpine should be used routinely after tonometric measurements in glaucomatous patients. Tonometric measurements alone are not sufficient to determine the progress of glaucoma; the vision and visual fields are just as important. Paracentral scotomas are easily overlooked. Patients who have glaucoma should be informed that their sight is worse in dull light, and that they should avoid it as far as possible. The progress of glaucoma depends partly upon general well-being, and the patient should avoid caffeine as well as physical and mental excitement and exhaustion. Glaucomatous patients whose tension is not completely under control should be examined at intervals of not more than 15 days. Glaucoma is frequently controlled by miotics but seldom cured, and one must continue the use of miotics even when the tension is under control. When operation becomes nec-

essary because miotics no longer control the tension it should be performed promptly. Orbital alcohol injections do not replace operation. Paracentesis should be avoided in primary glaucoma. Paracentral scotoma may become central after operation. Normal tension after fistulizing operations does not necessarily insure the retention of vision throughout life. After glaucoma operations general health and well-being should be maintained at its maximum.

Chas. A. Bahn.

Coppez, Leon. The pyrometric electrode in Vogt's glaucoma operation. *Ophthalmologica*, 1945, v. 109, Feb.-March, pp. 80-101.

It is not enough to know the strength of the current in diathermy. The factor of greatest importance is the temperature that is produced in the tissue. This can be measured by means of the pyrometric electrodes that the author described several years ago. Tissue damage can only be avoided if the temperature is carefully measured and is known throughout the procedure. The author discusses the physical basis of the method of temperature control in great detail and describes his method of surgical operation. The latter is a modification of Vogt's diathermy puncture; a flat electrode is placed directly on the denuded sclera over the flat part of the ciliary body.

Alice R. Deutsch.

Icaza, M. J. Medical treatment of acute glaucoma. *Arch. of Opth.*, 1946, v. 35, April, pp. 361-365.

As an aid to the treatment of acute glaucoma the author uses a retrobulbar injection of one cc. of a 2-percent procaine hydrochloride solution to which 0.0001 gm. of epinephrine hydrochloride has been added. Pilocarpine and physostigmine are instilled into the eye before and after the retrobulbar injection. This treatment is followed by prompt loss of pain and congestion and the eye becomes soft. Eyes so treated can be operated upon days or weeks later under perfect conditions of tension for the operation, and the patient will not have suffered a recurrence of pain in the meantime. John C. Long.

Jayle, G. E., and Schachter, M. Hypophysis and glaucoma. Statistical study of the characteristics of the arterial pressure in glaucoma. *Presse Medicale*, 1946, No. 4, Jan. 26, p. 51.

The authors discuss the role of the endocrine glands, in particular the hypophysis, in glaucoma and mention the decrease in intraocular pressure which accompanies the physiologic hyperpituitarism of pregnancy. They note that glaucoma almost never occurs during pregnancy and that hypotension is a feature of acromegaly, chromophobic pituitary adenoma, and the syndrome of Babinski-Froelich. In contrast they note the permanent or recurring attacks of ocular hypertension and rise in blood pressure in Cushing's syndrome. They note that in Simmond's disease there is marked arterial hypotension where there is marked hypofunction of the gland. They make a statistical comparison of the arterial pressures in 45 cases of chronic glaucoma and compare them with the pressures in Simmond's disease and Cushing's syndrome. They found hypertension in 75 percent of the patients with glaucoma, in 87 percent of those who had Cushing's syndrome, and in two percent of those with Simmond's disease. They note the importance of age in glaucoma and its

lesser importance in the two pituitary syndromes but conclude that the findings point to a possible pituitary role in the production of chronic glaucoma.

Phillips Thygeson.

Law, F. W. **Glaucoma**. *Guy's Hospital Gazette*, 1946, v. 60, March 16, p. 66.

In this lecture, the author stresses the anatomical factors in the etiology of the various forms of glaucoma. In each instance he refers the ultimate cause to narrowing or obliteration of the chamber angle. Secondary glaucoma is considered briefly, and mention is made of the manner in which such diseases as iridocyclitis, hyphema, subluxation of the lens, and intraocular masses produce glaucoma by their effect upon the chamber angle.

Primary glaucoma is described under the headings of congenital, chronic simple, acute and chronic subacute. The author differentiates between chronic simple glaucoma, which he describes as entirely symptomless, and chronic subacute glaucoma, characterized by symptoms generally described in textbooks under the heading of chronic simple glaucoma.

The treatment of secondary glaucoma must be directed toward the causative factor. In the acute primary type medical treatment should be applied for one or two days before resorting to surgery. Chronic glaucoma should be treated as acute during attacks, using miotics, heat, morphine and dehydration. The aim of all surgery in primary glaucoma is to provide a new area of drainage for the aqueous.

Benjamin Milder.

Rednót, Magda. The origin of hypotony of the eye. Ocular findings in orthostatic hypotony. *Klin. M. f. Augenh.*, 1943, v. 109, March-April, p. 161.

The term orthostatic hypotony was coined in 1932 by Laubry and Doumier. Formerly the symptom complex was called postural hypotension by Bradburg and Eggleston in 1925. The most pronounced symptoms of the disease are vertigo and unconsciousness accompanied by a rapid decrease of the systolic and diastolic blood pressure as well as increase of pulse rate in the upright position. These patients perspire only slightly if at all. Secretion of urine is increased during the night, when the body is in a horizontal position. The basal metabolic rate is somewhat subnormal. Disturbances of the organs of internal secretion are common. One case of typical orthostatic hypotony in which the author was able to observe a number of interesting ocular symptoms is reported. A man, 57 years of age, had functional disturbances of the hypophysis, but no Addison's disease, tabes dorsalis or other neurological ailments. He was admitted to the hospital because of severe vertigo. He had convergent strabismus with normal vision in the right eye and amblyopia in the left. In the horizontal position the ocular tension was 17 mm. Hg and was not influenced by mydriatics. After several up and down movements of the body it went up temporarily to 22. In the sitting position the tension dropped to six, and the patient complained of vertigo. When the patient stood up tension fell below four mm. Hg, and he lost consciousness. The fundus was pale and pulsation of the retinal arteries was visible. The blood pressure was reduced to 60 mm. Hg. The variation of the ocular tension is a new symptom of

McPherson, S. D. Jr. **Cyclodialysis in the treatment of glaucoma**. *Amer. Jour. Ophth.*, 1946, v. 29, July, pp. 848-853. (6 tables, references.)

orthostatic hypotony. Its decrease is caused by the fall of the blood pressure, a sign of disturbance of the peripheral sympathetic system. The retinal blood pressure was measured with Baillard's and Kukán's dynamometer. Variations in ocular and vascular tension follow parallel courses as in some cases of neurasthenia, poisoning with chloral hydrate, typhoid fever, and particularly in the comatous stage of diabetes. (References.) F. Nelson.

Riddell, W. J. B. Tangential displacement of the iris in chronic glaucoma. *Brit. Jour. Ophth.*, 1946. v. 30, Feb., pp. 74-81.

The author describes a tangential displacement of the radial fibers of the iris in chronic glaucoma. It is certainly a stage in the atrophy of the iris in advanced glaucoma but it can occur early. He briefly describes its appearance in 14 of 35 consecutive cases of glaucoma. Morris Kaplan.

Smith, J. H. The blood-aqueous barrier in hydrophthalmic rabbits. *Ophthalmologica*, 1944, v. 108, Dec., pp. 293-297.

The university eye clinic in Basel successfully bred a strain of hydrophthalmic rabbits with greatly increased ocular tension. A solution of fluorescein sodium was injected subcutaneously into such rabbits as well as into normal rabbits. It was found that the fluorescein appeared later in the aqueous of the hydrophthalmic rabbits and that its flow across the blood-aqueous barrier is, considerably slower than in the eyes of normal rabbits. (References.) Max Hirschfelder.

Weekers, L., and Weekers, R. The hypotensive effect of diathermy on the

ciliary body without perforation of the sclera. *Ophthalmologica*, 1945, v. 109, April-May, pp. 212-226.

The authors describe a modification of Vogt's diathermy-puncture which they call nonperforating cyclodiathermy. They discuss the technique of this operation, its effect on the intraocular tension, its influence on the visual acuity and fields, its possible post-operative complications, as well as its advantages as the operation of choice in chronic, secondary, and absolute glaucoma.

They use the ophthalmic diathermy apparatus on a bipolar current. The active electrode consists of a small cylinder .75 millimeter in diameter and one millimeter long which is fitted to a curved metal arm to control the isolation and limit the penetration. They instill a local anesthetic and prolong anesthesia by retrobulbar injection and warn against the use of subconjunctival injections because of the chemosis which follows. The electrode is applied directly to the eyeball without dissecting the conjunctiva. Pressure is necessary to maintain contact. Eight applications are made seven millimeters from the limbus, in regular intervals so spaced as to avoid the insertions of the ocular muscles. The time of application is 15 seconds. The operation is effective in chronic glaucoma because it produces permanent increase in the lumen of the uveal vessels which results in increased resorption of the intraocular fluid. Usually some atrophy of the ciliary body develops which is also a factor in reducing tension because less aqueous is produced. The operation is indicated in both secondary and absolute glaucoma. Alice R. Deutsch.

Weekers, Roger. A contribution to the study of incomplete glaucoma. *Oph-*

thalmologica, 1943, v. 105, June, pp. 307-317.

If one or the other of the classical symptoms of glaucoma is missing, so called incomplete glaucoma is the result. The monosymptomatic glaucoma which manifests normal tension, normal fields but a distinct pathological cupping is the special study of this paper.

The author observed eight patients affected with this disease. The first patient had the monosymptomatic glaucomatous cupping in one eye only without any other change. Two patients had the same disease in both eyes. Two others had the monosymptomatic glaucomatous cupping in both eyes and an enlargement of the blind spot in one eye. Two others had nerve-fibre scotomas and nasal contraction of the fields with a glaucomatous cupping. The last patient was especially interesting. He had an absolute glaucoma in one eye and a typical monosymptomatic cupping in the other.

This small list of case histories shows the intermediary stages between the monosymptomatic cupping without ocular hypertension and the typical chronic glaucoma with ocular hypertension, field restrictions and visual loss to complete blindness. (6 fields, 1 table, references.)

Alice R. Deutsch.

Westerlund, E. The heredity of congenital hydrophthalmos. *Acta Opth.*, 1944, v. 21, pt. 4, pp. 330-348.

The material is gathered from the records of the Institution for the Blind in Copenhagen, during the period 1881-1942. The total number of children with buphthalmos was 97; in 23 of them it was familial. A detailed analysis of these cases indicates that the mode of heredity in buphthalmos is

recessive. It thus appears, that this form of glaucoma differs genotypically from juvenile and senile glaucoma, which are dominant. The data also reveal that in siblings the course and final outcome of the disease bear the stamp of a familial peculiarity.

Ray K. Daily.

9

CRYSTALLINE LENS

Atkinson, W. S. Corneal section with long bevel and conjunctival flap for cataract extraction. *Arch. of Opth.*, 1946, v. 35, April, pp. 335-345.

The author advocates corneal incision with a long bevel and a conjunctival flap made by keratome and scissors. The long bevel combined with McLean sutures prevents a leaky wound with shallow anterior chamber and also prevents prolapse of the iris. The location in the avascular cornea decreases the incidence of postoperative hemorrhage. The technique of the operation is described in detail. The corneal shelf makes it necessary to deliver the lens by tumbling. Three hundred cases of cataract extraction are reported, divided into groups of 100 each. The last 100 operations were performed according to the technique described. The case reports indicate that the long-beveled corneal section results in superior visual acuity and fewer complications. John C. Long.

Bracken, F. Complications incident to simple intracapsular extraction. *Arch. of Opth.*, 1945, v. 34, Nov.-Dec., pp. 427-430.

Well placed sutures are the best defense against complications with the simple intracapsular operation. The author uses a corneoscleral mattress suture centrally and at least one addi-

tional corneoscleral suture on each side. Rupture of the hyaloid or prolapse of vitreous necessitates a complete iridectomy. Prolapse of the iris is treated as early as possible, either by excision or by replacement and the use of additional sutures. Since he uses corneoscleral sutures the author has found an empty chamber on the morning after surgery in only 0.28 percent of his patients. The technique of delivering the lens is discussed.

John C. Long.

Bracken, F. Instruments for use in operation for cataract. *Arch. of Ophth.*, 1945, v. 34, Nov.-Dec., pp. 430-431.

An anterior chamber irrigator shaped like an iris repositor and attached to a rubber bulb is described. A sharp heavy globe fixation forceps is illustrated. A corneoscleral suture forceps not unlike a miniature Elschnig forceps is described. This forceps has round, needle-sharp teeth and is used to grasp the edge of the cornea or the episclera without pressing on the globe. (3 photographs.)

John C. Long.

Broendstrup, Poul. The function of the retinal periphery in uncorrected unilateral aphakia. *Acta Ophth.*, 1944, v. 21, pt. 4, pp. 303-315.

The tabulated data on the visual fields of 24 persons with unilateral aphakia show that in the aphakic eye there is a moderate narrowing of the visual field amounting to about 10 degrees, which must be attributed to the reduced refractive power of the eye. Such an eye, however, contributes to the total function of the eyes and the desirability of additions to the binocular visual field is an indication for a cataract extraction.

Ray K. Daily.

Chace, R. R. Congenital bilateral subluxation of the lens. *Arch. of*

Ophth., 1945, v. 34, Nov.-Dec., pp. 425-426.

Dislocated lenses in the eyes of a girl, six years of age, are described. The child's maternal grandfather, her mother, and a maternal aunt all had the same condition in both eyes. All were operated upon with varying results; in one of them the operation was followed by glaucoma and later by detachment of the retina.

John C. Long.

Doggart, J. H. Partial cataract in men of military age. *Arch. of Ophth.*, 1946, v. 35, March, pp. 280-290.

Although the word "cataract" is often understood to mean a serious disturbance of the lens in one or both eyes, it has a less sinister significance in ophthalmologic circles, where cataract is defined as a partial or complete decrease in the transparency of the lens. Thus, the term used in its technical sense embraces numerous examples of lenticular opacities which are innocent in that they are either stationary or else advance so slowly as to entail no appreciable handicap within the average span of life.

This survey arose out of the interest shown by the Medical Directorate of the Royal Air Force concerning the relative frequency and practical significance of certain forms of opacities of the lens among men of military age.

In this very readable paper, the author gives the following summary of his investigation.

1. Three hundred men, selected at random, and not complaining of ocular symptoms, were searched for the presence of cataract, so far as that condition is accessible to view through the undilated pupil under the magnification of a loupe.

- 2. Their ages ranged from 19 to 60 years. The average age was 28.2 years. The percentages of air crew members and ground staff were, respectively, 63 and 37.
- 3. The total incidence of cataract was 94.3 percent. Many of the men displayed more than one form of opacity, so that the percentages of the individual types of cataract totaled more than 100. The distribution was as follows:

Type of Cataract	Percent-age
Scattered dots (including dust-like opacities in concentric layers)	93.0
Cataracta centralis pulverulenta	21.7
Coronary cataract	6.0
Anterior axial embryonic cataract	4.0
Dilacerated cataract	1.3
Suture cataract	1.0
Anterior capsular cataract	1.0
Senile cataract	0.3

Doggart concludes that cataract is common and usually harmless and if mentioned at all, the doctor should give a prognosis based on a close study of the type of cataract encountered.

R. W. Danielson.

Greene, P. B. *Keratoconus posticus circumscriptus*. Arch. of Ophth., 1945, v. 34, Nov.-Dec., pp. 432-433. (See Section 6, Cornea and sclera.)

Gundersen, Trygve. Observations on the Vossius ring. Amer. Jour. Ophth., 1946, v. 29, July, pp. 837-845. (1 table, references.)

Lawrence, R. D. Temporary cataracts in diabetes. Brit. Jour. Ophth., 1946, v. 30, Feb., p. 78-81.

In two myopic patients who had

been examined at the onset of diabetes and were at that time found to have clear lenses, lenticular opacities appeared 16 days and three days after commencement of a restricted diet and treatment with insulin. They lasted three to five weeks and disappeared entirely. It is suggested that these lens changes were brought on by changes in hydration, both dehydration and rehydration.

Morris Kaplan.

Steffen, R. Posterior pseudo-lenticulus. Klin. M. f. Augenh., 1943, v. 109, March-April, p. 176.

The definitely soft blind eye of a child, two years of age that had an opacity in the posterior portion of the lens, a pea-sized shadow behind it, and whitish strands in the vitreous, was enucleated because of the possible presence of an intraocular tumor. Biomicroscopically loose strands that originated in the region of the disc and spread into the tumor-like mass behind the lens were seen. The retina was partially detached. Histologic sections revealed a cone-shaped protrusion of the posterior surface of the lens that was probably not a congenital malformation but probably a mass of retrolental connective tissue. Apparently an organized inflammatory exudate that compressed the lens peripherally caused the conical bulging of its posterior portion. Clinically the lesion gave the impression of a tumor and might be classified as a pseudo-glioma. (2 photographs, references.)

F. Nelson.

Suellmann, H. The tryptophan content of the lens proteins. Ophthalmologica, 1944, v. 108, Dec., pp. 281-287.

The tryptophan content of the lens proteins in the eyes of calves, cattle, and pigs was determined by the author.

He used various methods (formaldehyde reaction, glyoxal acid reaction) with hydrolysed and non-hydrolysed lens protein and found that tryptophan is 3.5 to 5.3 percent of the total protein. Beta-crystalline contained the most, alpha-crystalline the least tryptophan. The result in cataractous lenses did not vary from those in young lenses. The values obtained by the various methods are critically dealt with and compared with those found by other authors. (Literature.) Max Hirschfelder.

Vetter, J. **Bilateral atypic lens coloboma connected with ectopia.** Klin. M. f. Augenh., 1943, v. 109, March-April, p. 180.

A man 40 years of age who had worn glasses since he was seven years of age had noted diplopia, and later multiple vision, for 19 years. One of the double images often changed its position, especially when he was riding a bicycle on rough pavement. The right lens had been needled previously but was only partially absorbed. Both lenses were small, dislocated toward the nasal side, and had indentations on the temporal side. The zonula fibers were small in number and atypically arranged. Accommodation was almost normal. Iris and choroid were normal. No malformation of the eyes were noted in other members of the family, although two sisters were myopic (7 D. and 20 D.). For the development of atypic coloboma a complete lack of zonula fibers in the colobomatous area is not necessary. Defects in the equatorial region can be caused by a subnormal number of fibers particularly if the normal function of the single fiber is impaired by abnormal arrangement. Coloboma of the lens is probably not a primary inherited malformation but may be secondary to changes in the develop-

ment of the mesodermal tissue in the interior of the eye. (2 pictures, references.) F. Nelson.

Weekers, Roger. **Cataracts in hypocalcemia and their medical treatment.** Ophthalmologica, 1944, v. 107, May-June, pp. 257-281.

After a short review of experimental cataract and a discussion of its pathogenesis and treatment, the author reports nine cases of hypocalcemic cataract in detail. Seven followed strabismus and two were combined with idiopathic tetany. He also mentions the cataracts which develop in hypocalcemia without parathyroid insufficiency, as in nontropical sprue, dinitrophenol poisoning and severe nutritional deficiencies, as well as the similar cataract of myotonic dystrophy.

The morphologic picture of hypocalcemic cataract is characteristic. After a stage of swelling of the lens and an increase in refraction, small radial superficial opacities and colored crystals appear under the posterior and anterior capsule. The nucleus usually loses its transparency before the whole cortex is involved.

The author emphasizes the importance of preventive measures and early diagnosis of the hypocalcemia by checking the calcium content of the blood frequently. Medical treatment is promising, even when signs of visual disturbances are already present. A lenticular myopia may disappear without a trace. The same is true for incipient opacities but when they reach a certain density the process is not reversible.

The drugs used to bring the calcium content of the blood to normal levels are vitamin D, AT 10 which is irradiated dehydrotachisterol, and para-

thyroid extracts. In favorable cases they prevented and retarded the development of cataracts. (References.)

Alice R. Deutch.

Wolff, Eugene. Some aspects of the normal histology of the suspensory ligament of the lens. *Proc. Roy. Soc. Med.*, 1946, v. 39, March, p. 253.

The suspensory ligament of the lens is found to be composed of posterior fibers from the ora that are inserted into the posterior lens capsule, anterior fibers from the valleys between the ciliary processes and the pars plana, auxiliary fibers, and equatorial fibers which decrease in number with age. The "hyaloid" quality of the anterior hyaloid membrane is believed to be due to the hyaloid zonular fibers.

There is still a question as to the origin of the zonular fibers. The author believes that they pass to the internal limiting membrane of the ciliary body, although they may appear to have an interepithelial origin because of the concealing effect of papillary projections of the nonpigmented cells of the ciliary epithelium.

Benjamin Milder.

10

RETINA AND VITREOUS

Arruga, H. Origin and healing of retinal detachment. *Klin. M. f. Augenh.*, 1943, v. 109, March-April, p. 145.

Since Gonin published his studies it is generally recognized that the formation of a hole or tear in the retina is responsible for its detachment and that a cure can be accomplished by closing and attaching the torn area. Holes can be caused by degenerative or inflammatory changes in the retinal tissue, very frequently where retina and vitreous body are adherent to each other.

Experimental chemical or thermal irritation applied to the surface of the sclera of the eyes of dog, rabbit or cat invariably cause adhesion of the retina to the vitreous that can be seen anatomically. However a retinal detachment does not result from such an irritation since all three membranes, sclera, choroid and retina, are involved in the inflammatory process that follows the irritation. In human eyes a retinal detachment occurs rarely in the presence of a serous choroiditis, but can be more frequently expected when a chorioretinal inflammation predominates in the retina to such a degree that adhesion between choroid and retina does not take place. Shrinkage and retraction of the vitreous body is a physiological process which is progressive from childhood to old age. In the production of retinal holes and subsequent detachment this shrinkage plays a major part, especially where adhesions between retina and vitreous exist. Cystic degenerations in the retinal tissues are often the cause of hole formation. The formation of horseshoe tears in the retinal periphery is influenced by the direction and number of nerve fibers which is diminished toward the periphery. Blood vessels and nerve fibers form the skeleton of the retina. Hole formations in the vicinity of the disc where the layer of nerve fibers is thicker than elsewhere are extremely rare and they are not uncommon in the macula where vessels are absent. When idiopathic retinal detachment occurs only the retina shows pathological changes. The more pronounced the changes are the more serious is the prognosis. Most commonly retinal detachment seems to be produced by a tear in the retina where it is attached to the structure of the vitreous body and where the choroid is nor-

mal. The movements of the vitreous enlarge the holes. Vitreous and eye movements play the most important role in the healing process; it depends upon the absorptive action as well as on the inflammatory reaction of the choroid (adhesive choroiditis). The retina itself plays a passive part only.

F. Nelson.

Benkwith, K. B. **Retinal hemorrhage as seen in an atomic-bomb casualty.** *Amer. Jour. Ophth.*, v. 29, July, pp. 799-800. (1 figure, 1 color plate.)

Bhalerao, C. K. **Retinitis pigmentosa.** *The Antiseptic*, 1946, v. 43, March, p. 173.

The author restates the more important knowledge of retinitis pigmentosa. He advises sight saving class early for patients of this type in order to comfort them when the disease is advanced.

I. E. Gaynon.

Blum, J. D., and Jeanneret, H. **A new anticoagulant in the treatment of retinal venous thrombosis.** *Ophthalmologica*, 1944, v. 108, Sept., pp. 129-136.

Dicoumarin was originally a product of sweet clover but was synthesized in 1941 and has been in use since 1942. It increases coagulation time by retarding the formation of prothrombin, although the variations in coagulation time in prothrombin time are not proportionate.

The dosage varies between one-half and four milligrams per Kilogram of bodyweight per day. Its action is slow and its anticoagulant effect becomes manifest after 48 to 72 hours. After that time the prothrombin time must be checked regularly. A prothrombin time of 30 to 45 seconds is considered

to be within safe limits, 60 to 80 seconds is a danger sign.

Contraindications in the use of Dicoumarin are malignant vascular sclerosis, arterial hypertension, and increased capillary permeability.

Its advantages, if compared with heparin, are the reasonable price, the administration by mouth, and its prolonged action.

Seven case histories are reported in detail. Three patients had complete thrombosis and four had thrombosis of a branch of the retinal vein. The practical value of the combined use of heparin and dicoumarin is outlined. (2 figures, references.)

Alice R. Deutsch.

Canella, Francisco. **Bilateral thrombosis of the central retinal vein.** *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, March, pp. 164-168.

A case report.

J. Wesley McKinney.

Casanovas, Jose. **Grouped pigmentation of the retina.** *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Feb., pp. 129-132.

The author reports a case of a rare congenital anomaly described by Niels Hoeg under this name, by Leber under the name of nevoid pigmentation of the retina, and by Kraupa as melanosis of the retina. The anomaly consists of a grouped formation of round or polygonal dark areas, located behind the retinal vessels in some segment of the retinal periphery. It is formed in the early stages of ocular development, and is due to an irregular distribution of the cells in the retinal pigment layer. Its clinical significance lies in the possibility of its confusion with hemorrhages or pathologic pigmentation. (2 colored illustrations.) Ray K. Daily.

Cockburn, C. *Ocular cysticercus celulosae*. Brit. Jour. Ophth., 1946, v. 30, Feb., pp. 65-74. (See Section 17, Systemic diseases and parasites.)

Cridland, Nigel. *Neuroretinitis of unknown origin*. Proc. Roy. Soc. Med., 1946, v. 39, March, p. 245.

A man, 24 years of age, suffered a progressive loss of the peripheral field to five degrees, in a period of six months. The visual acuity remained 6/5, and the fundus appeared normal. Three months later the field was smaller (three degrees), and a trephine operation was performed to aid retinal circulation. There was no further change in the field or visual acuity. The fundus showed some fine pigment deposits along the inferior nasal vein and equivocal retinal edema. After three years there is no further change, except for fine diffuse areas of chorioretinitis. The only explanation offered was that the initial lesion was a superficial widespread choroiditis.

Benjamin Milder.

Granström, K. O. *Retinal hole observed fifteen months before detachment of the retina*. Acta Ophth., 1943, v. 21, pt. 3, pp. 204-209.

In the emmetropic eye of a woman, 54 years of age, a typical retinal hole was observed fifteen months before retinal detachment occurred. A review of the literature shows a divergence of opinion as to the necessity of surgical treatment for such eyes. The occurrence of detachment in this patient leads to the conclusion that a prophylactic operation should have been performed.

Ray K. Daily.

Gronvall, Herman. *A case of chloroma of the orbit with fundus changes*. Acta Ophth., 1944, v. 21, pt. 4, pp. 206-

266. (See Section 13, Eyeball and orbit.)

Harlow, H. D. *Retinal detachment secondary to conglomerate tubercle of the choroid*. Amer. Jour. Ophth., 1946, v. 29, July, pp. 869-871. (References.)

Jebejian, R., and Kalfayan, B. *The oculo-bucco-genital syndrome*. Ann. d'Ocul., 1945, v. 178, Aug., pp. 335-344. (See Section 7, Uveal tract, sympathetic disease, and aqueous humor.)

Jevons, N. A. *A case of eclipse blindness*. Brit. Jour. Ophth., 1946, v. 30, Feb., pp. 84-85.

A case of eclipse blindness that appeared a few hours after exposure is described. It was characterized by diminished vision, a positive scotoma, and an obvious hole in the macula. The damage apparently was permanent. (Illustration.) Morris Kaplan.

Louis-Bar, D., and Pirot, G. *Spastic paraplegia combined with degeneration of the macula in two brothers*. Ophthalmologica, 1945, v. 109, Jan., pp. 32-43.

In presenting the unusual occurrence of several degenerative diseases in two brothers, the authors take the opportunity to discuss the interesting problem of the heredity of pathologic lesions and their simultaneous occurrence in one individual. The brothers had a degeneration of the macula associated with a spastic paraplegia of the Strümpel type. In one of them it was the infantile form and in the other the adult form. In one of them the spastic paraplegia was accompanied by an amyotrophic spinal lesion. A third member of the family had an atypical spastic paraplegia. The investigation of the heredity of the abnormalities in the family was necessarily incomplete.

The authors believe that the degenerations of the macula in their patients were of the type described by Franceschetti in patients with Freidreich's ataxia. No similarly afflicted family has been described. Alice R. Deutsch.

Ortin, G. L. **Retinitis pigmentosa.** Arch. de la Soc. Oft. Hisp.-Amer., v. 5, Feb., pp. 92-111.

The importance of consanguinity and the futility of therapy are the features emphasized. After surveying briefly the known facts in the pathogenesis of the disease Ortin concludes that the primary lesion is a destruction of the neuro-epithelium. Reference is made to McDonald's and Adler's study on the relation of pituitary disease to retinitis pigmentosa, and their opinion denying the influence of a pituitary hormone is accepted. The therapeutic procedures advocated are mentioned with scepticism in their efficacy. In the author's personal experience injections of acetylcholin and atropin intravitreally and retrobulbarly were without effect. Effective prophylaxis through genetic regulation and elimination of consanguinous marriages, is strongly urged. (8 fundus photographs, 32 visual fields.) Ray K. Daily.

Panneton, P. **A curious lesion of the fundus.** Arch. d'Ophth., 1945, v. 5, no. 3, p. 328.

The author describes the eyes of a man, 44 years of age, with vision reduced to 0.2 in the right eye as the result of infectious keratitis that had occurred some two months before examination. The left eye was externally normal and had a vision of 0.9. In this eye, however, there was a whitish mass at the upper temporal margin of the nervehead about half the size of the disc in area. The mass was elevated

about three diopters and the borders were sharp. The color was a grayish white with a suggestion of cholesterin crystals. The mass obscured the upper temporal vessels. Otherwise the fundus was completely normal. The author discusses the various etiological possibilities, particularly gumma, tuberculoma, and tumor. He suggests that the mass may be a conglomeration of cholesterin crystals.

Phillips Thygeson.

Pinkerton, O. D. **Angioma of the retina.** Amer. Jour. Ophth., 1946, v. 29, June, pp. 711-712. (3 figures.)

Ploman, K. G. **Treatment of thrombosis of the retinal veins with heparin.** Acta Ophth., 1943, v. 21, pt. 3, pp. 190-203.

This report is based on 41 cases of thrombosis of the central retinal veins and 40 cases of thrombosis of tributary veins. The tabulated data show that the best results were obtained in younger patients and in those in whom therapy was instituted early. The patients who were not benefited had hemorrhages into the vitreous or the retina. Secondary glaucoma and central choroiditis were causes of failure in some patients. When the thrombosis occurred in a branch of the vein, improvement was noted in the eye of almost half of the patients. In practically every case sinuous veins, uneven in calibre, and with thickened walls were left in the affected area. Similar changes took place in the concomitant artery. It is useless to treat patients with massive hemorrhages that obscure the papilla and the macula, and those who have increased tension. Impairment of visual acuity should not be the deciding factor, because it sometimes improves rapidly during the

course of treatment. If the papilla is visible, and the hemorrhages not too extensive, heparin should be tried.

Ray K. Daily.

Poirier, R. A. Saccular prolapse of the vitreous body. *Amer. Jour. Ophth.*, 1946, v. 29, July, pp. 845-847. (References.)

Rasmussen, Knud. Retinoblastoma in a man forty-eight years of age. *Acta Ophth.*, 1943, v. 24, pt. 3, pp. 210-213.

To the small number of reported cases of this tumor in adults, the author adds one. The patient was treated for two years for keratitis, iritis, and secondary glaucoma. When light perception was gone, the eye was finally enucleated, and was found to contain a retinoblastoma. (1 illustration.)

Ray K. Daily.

Redslob, E., and Koutseff, A. Postpartum retinopathy. *Ann. d'Ocul.*, 1945, v. 178, Oct., pp. 425-440.

During pregnancy ovarian hormones, especially folliculin, and placental hormones greatly increase the activity of the entire endocrine mechanism, especially the pituitary which physically, by swelling, produces bi-temporal field contractions and chemically by the increased hormone production, especially of oxytocin, partly causes the uterine contractions of labor. Among the abnormalities of this complexly balanced process are quantitative and qualitative changes in the vaso-pressor system which produce hypertension in the predisposed. The stages are angiospasm, angiosclerosis, exudation with or without necrosis, and other complications. The tissues most frequently involved are the kidneys, the liver and the retina. In severe forms, eclampsia with retinopathy results. The tendency to angiospasm and there-

fore hypertension in pregnancy is aggravated by vaso-pressor hormones such as vasopressine, adrenalin, and folliculin. Generally speaking, the severity of the retinopathy is proportionate to the vascular hypertension rather than to the kidney involvement. Two illustrative cases are presented, both apparently with hereditary lues. In the first patient eclampsia with bilateral retinal exudation and detachment occurred several hours after a normal labor. A subsequent pregnancy was terminated to save the life of the patient. The second patient also developed eclampsia and bilateral retinal exudation and detachment after she had been delivered of an apparently normal child during the seventh month of pregnancy. Three months later the eye and vision were normal. (15 references.)

Chas. A. Bahn.

Rosengren, B., and Stenstrom, S. Thirty cases of thrombosis of the retinal vein treated with heparin. *Acta Ophth.*, 1942, v. 20, pt. 2., pp. 145-152.

The conclusions are based on a detailed analysis of 30 cases. After 250-375 milligrams of heparin had been administered daily for an average of 10 days, visual acuity had improved in 21 patients, had deteriorated in five, and remained unchanged in four. The average visual acuity before heparin therapy was .239; at the end of heparin therapy, it rose to .375. After the administration of heparin was discontinued, there was a slight loss. These findings support the belief that in many cases heparin therapy leads to improvement, which is later partially lost.

Ray K. Daily.

Scheie, H. G., and Freeman, N. E. Vascular disease associated with angioid streaks of the retina and pseu-

doxanthoma elasticum. Arch. of Ophth., 1946, v. 35, March, pp. 241-250.

During the past two years angioid streaks of the retina were seen in three patients, in two of whom pseudoxanthoma elasticum was also present. In these two patients severe vascular disturbance was found in all the extremities. No mention of a relationship of these three conditions has been found in the available literature and whereas the association is probably significant, the cases are being reported.

Pseudoxanthoma elasticum is a degenerative disease of the skin. The co-existence of osteitis deformans and angioid streaks of the retina is also noteworthy.

Angioid streaks of the retina are rather rare. The retinal picture is characteristic. It consists of pigmented streaks, radiating spokelike from a similarly pigmented ring which encircles the disk. This ring may be complete or incomplete and may be formed by a single pigmented line around the disk, or it may be made up of several interlacing lines of pigment. It may encircle the disk closely, with only a small band of retina intervening, or the ring may be 0.5 d.d. or more away. The borders are serrated.

Pseudoxanthoma elasticum is an abnormality of the skin that is made manifest by yellowish patches, that vary in size from that of a pinhead to that of a pea, with roughening of the skin much like the striae atrophicae of pregnancy.

Obstruction of peripheral blood vessels or serious circulatory disturbance has not previously been reported.

The angioid streaks of the retina, pseudoxanthoma elasticum, and vascular disturbance reported in two patients were believed to be a manifesta-

tion of a general degeneration of elastic tissue throughout the body and will probably be found to occur together not infrequently when such cases are studied with this in mind.

R. W. Danielson.

Vail, Derrick. The scleral-resection (eyeball-shortening) operation. Amer. Jour. Ophth., 1946, v. 29, July, pp. 785-799. (1 color plate, 7 figures, references.)

Van Manen, J. G. Congenital sickle-shaped retinal detachment and associated congenital anomalies. Ophthalmologica, 1944, v. 107, March-April, pp. 121-148.

Two congenital anomalies of the fundus were seen by the author in the Netherlands-Indies where congenital anomalies of the eyes are not rare among the natives and are favored by intermarriage of members of the same tribe.

In a boy 16 years of age whose left eye only was affected, the optic disk was pale and a grayish transparent strand extended towards the periphery in the horizontal meridian. Another but shorter and less transparent strand surrounded the region of the macula like a dense sheath. It extended straight into the vitrous perpendicular to the retina, and with the other strand formed a fanshaped veil which reached the ora serrata. In the region of the posterior pole there were spots of fine pigment and coarse dots with many glittering points in the retina, which was scarcely pigmented at all elsewhere. The lens was clear. The eye was emmetropic and vision was reduced to the ability to count fingers at two meters.

The second case occurred in a boy, six years of age. He had a typical sickle-shaped congenital retinal de-

tachment in the inferior temporal quadrant that was more pronounced in the left eye where it was associated with an anomaly of the retinal artery. Nystagmus was present and his vision was very poor.

The author also reviews ten cases of this eye affection which were reported under different names and discusses the pertinent pathologic studies.

To explain the probable genesis of sickle-shaped, congenital retinal detachment and allied anomalies a detailed embryologic study is added to this paper. Superficial branches of the hyaloid artery which normally are obliterated in the 40 millimeter stage retain their delicate fibrillary connection with the retina and by their persistence nourish and increase the growth of the mesoderm at the lens equator. The latter adheres to the adjoining retina. The growing eyeball stretches the persistent vessels which are covered by the congenital neuroglia of Bergmeister and by the mesoderm at the posterior lens capsule. The retina, fixed to the vessels, must give way and form a fold. (6 figures, references)

Alice R. Deutsch.

Weber, Ernst. Biomicroscopic investigation of the anterior limitation of the vitreous and its connection with the lens. *Klin. M. f. Augenh.*, 1943, v. 109, March-April, p. 169.

In continuation of a previous article concerning the free layer of the vitreous lamella and its delimitation from the plicata, a lenticular membrane of the vitreous lamella is described which is often not visible but can become manifest in senile eyes and after post-traumatic and inflammatory processes. The free vitreous layer plus the lens lamella form the anterior limit of the vitreous which is visible in slitlamp

illumination. The plicata plays no important part as an anterior limiting membrane. Characteristic for the detachment of the lens membrane of the vitreous lamella are the following: (1) an optically empty space behind the lens, (2) the usual jerky movements are small or absent (in contrast to the plicata), (3) vivid iridescence, (4) the membrane is not folded like the plicata but is stretched tightly, (5) occasionally, especially after trauma, fine parallel striation is present, (6) usually it can be isolated from the rear surface of the lens only in very narrow optical sections. Detachment of the lens lamella can be proved by the visible continuation of the plicata, towards the vitreous lamella, direct transition into the free layer of the vitreous lamella, and by apparent detachment of the hyaloid canal at its insertion at the rear of the lens. Each one of these three symptoms is sufficient for the diagnosis of detachment of the lens lamella. (3 color plates, 4 drawings, references.)

F. Nelson.

Weekers, Roger. The impairment of the circulation and the function of the retina in the post-concussional syndrome. *Ophthalmologica*, 1944, v. 108, Oct.-Nov., pp. 169-186.

The post-concussional syndrome has been considered a manifestation of a neurosis or of simulation. The most important result of this study is the discovery of a new sign for its diagnosis, namely, the extension and abnormal increase of the angioscotomas. This observation also has a pathologic interest because it stresses the importance of circulatory changes. It is of practical interest because it helps to verify the diagnosis and to outline the seriousness of the affection, its course and prognosis.

The author describes the anatomy of the retinal and choroidal circulation and the methods for examination of the retinal function. The technique of the angioscotometry, its variations and the interpretations of its findings are discussed in detail as are the changes in the adaptation curves and in the color sense.

The author found that narrowing of the central and peripheral isopters can arise without excessive fatigue and without neurosis. This results from an extension of the vessel scotomas, as does the decrease in the visual acuity and retinal asthenopy. Under the technical conditions at hand, the dark adaptation only was impaired in several afflicted patients who also showed considerable contraction of the fields and impaired visual acuity. There was no change in the color sense other than a concentric contraction of the peripheral isopters for colors. The enlargement of the angioscotomas may arise from a change in the conduction of the neurons and synapses of the retina that is caused by disturbances of the circulation in the retinal vessels.

The study of the functional deficiency of the retina permits an approximate estimation of the severity of the post-concussional syndrome. In this respect three categories might be distinguished: grade 1, increased angioscotoma only, capable of improvement or complete recovery; grade 2, contraction of the middle and peripheral isopters, always accompanied by serious general symptoms and a slow recovery, grade 3, the impairment of the retinal circulation is so severe that not only the fields but also the visual acuity is very much impaired. The prognosis is grave. (2 field charts, references)

Alice R. Deutsch.

Weekers, R., and Humblet, M. **Physiological angioscotoma.** *Ophthalmologica*, 1945, v. 110, July-Aug., pp. 43-59.

The authors describe a new and especially exact method for plotting physiological angioscotomas. They discuss variations in angioscotomas, their theoretical significance, and their importance in health and disease. They correlate their findings with the appearance of the retina in ophthalmoscopy and in fundus photographs. The vascular origin of the behavior and etiology of these physiologic restrictions in the fields is clearly demonstrated. They use Bjerrum's tangent screen made of black wool that is free from reflections. The fixation point is a hole illuminated from behind by a red light. The tangent screen is uniformly illuminated by two tubes whose light is regulated by the interposition of a diaphragm. Three to five lux is the most desirable illumination. The testmarks are of a mat white and one to 15 millimeters in diameter.

In experimental anoxemia, in glaucoma, and after cerebral concussion, disturbances in the visual fields were found which resemble angioscotomas but are much broader and denser. Whenever this occurs the physiological angioscotoma disappears in the much larger pathological scotoma. (6 figures, references.) Alice R. Deutsch.

Zorab, E. C. **Solar eclipse—burn of macula.** *Brit. Jour. Ophth.*, 1946, v. 30, Feb., p. 82-84.

A soldier complained of reduced vision in the right eye four days after watching a partial eclipse of the sun intently without adequate protection. He complained of reduced vision in the left eye and the constant presence of a shadow. The shadow was of the

exact shape of the uneclipsed portion of the sun. This remained for 20 days and improved slightly. In each macula there was no light reflex and a dark red spot in the center about 0.25 mm. in diameter with a very pale arc surrounding it about 0.75 mm. in diameter.

Morris Kaplan.

11

OPTIC NERVE AND TOXIC AMBLYOPIAS

Antoine, R., Legroux, R., and Stricker, P. A case of severe quinine amblyopia. *Arch. d'Ophth.*, 1945, v. 5, no. 3, p. 349.

A case of toxic amblyopia following the ingestion of 6.0 gm. of quinine given for malaria is reported. Vasodilators were employed immediately but when the patient was first seen by the authors, several weeks later, there was complete mydriasis with absence of pupillary reflexes and of light perception. Injections of acetylcholine were given and the drug was applied to the sphenopalatine ganglia. There was improvement within 48 hours; light perception first returned in the temporal fields. After six days light projection was recognized everywhere except in the nasal fields and the visual acuity was 0.7 right eye and 0.5 in the left. Because the visual fields remained markedly constricted, the superior cervical sympathetic ganglia were infiltrated with procaine daily; definite improvement followed. Several months later the patient had a recurrence of malaria which was treated with quina-crine over a ten-day period. Although visual acuity remained unchanged after this treatment, there was marked contraction of the fields of the left eye. This contraction disappeared, however, after a single blocking of the superior cervical sympathetic ganglion.

The authors consider this case to be further proof of the role of vasoconstriction in the pathogenesis of quinine amblyopia. They discuss in some detail the anatomy of the cervical sympathetic chain and conclude that almost all vasodilator fibres pass by way of the superior cervical ganglion.

Phillips Thygeson.

Bordier, F. Inquiry into ocular intoxication caused by tobacco called "green." *Ann. d'Ocul.*, 1945, v. 178, Sept., pp. 370-376.

A farmer, 74 years of age, experienced amblyopia, central scotomata, internal ophthalmoplegia, slight myopia, and retinal arterial hypertension. These manifestations were apparently caused by smoking daily approximately 30 cigarettes of his home grown, home cured tobacco. After changing to another tobacco, possibly smoking less, and taking vitamin B, his symptoms disappeared. The author concludes that the home grown tobacco contained different toxic substances which affected the retinal cones and the contractility of the unstriated muscular tissue contained in the arterioles of the iris and ciliary muscle.

Chas. A. Bahn.

Falomir, Eduardo W. The problem of optic neuritis. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, March, pp. 169-172.

A brief discussion of the differential diagnosis of optic neuritis and papilledema is presented.

J. Wesley McKinney.

Porsaa, Kaj. Papilloedema in iridocyclitis. *Acta Ophth.*, 1944, v. 21, pt. 4, pp. 316-329.

Three cases are reported, one chronic and two acute. The edema in-

volved the optic nerve, blurring its margins, and extended into the retina, toward the fovea. There were a few exudates and hemorrhages in the edematous area, the retinal veins were engorged, and there were vitreous opacities. The ocular tension was normal. The vision was not impaired by this process and recovery was complete. Porsaa reviews the literature, which supports the theory that this is a toxic collateral edema, with stasis in the retinal veins, due to the inflammatory process in the anterior ocular segment.

Ray K. Daily.

12

VISUAL TRACTS AND CENTERS

Feigenbaum, A., and Kornblueth, W. **Paralysis of convergence with bilateral ring scotoma following injury to occipital region.** *Arch. of Ophth.*, 1947, v. 35, March, pp. 218-226. (See Section 4, Ocular movements.)

13

EYEBALL AND ORBIT

Babel, J., and Valerio, M. **Amputation-neuroma of the orbit.** *Ophthalmologica*, 1945, v. 109, June, pp. 317-323.

The authors describe two cases of amputation-neuroma in the orbit.

The eyeball of a man, 40 years of age, was enucleated because of recurrent inflammations which followed a perforating injury. Severe pain in the socket started several years later, after an apparently unimportant orbital trauma. The pathologic examination after surgical exploration showed a growth the size of a cherry stone, which was not encapsulated. It was a typical amputation-neuroma with chronic inflammatory cellular infiltration. In the stump of the optic nerve

there was a small granuloma with giant cells.

In the second patient the eyeball was removed because of complications after trachoma. Here a real tumor was not present, but a large number of myelin free nerve fibers in irregular arrangement. The ends of the severed nerves were visible and also many regenerated nerve fibres, but there were no inflammatory changes. There had been no pain before the operation.

The phenomenon of nerve regeneration in the orbit has never been described before though it does not seem to be rare. The ciliary nerves seem to be the origin of the tumor. It might be the cause of considerable pain after enucleation, especially if inflammatory foci should develop in the stump. (5 figures, references.)

Alice R. Deutsch.

Bendor-Samuel, J. E. L. **A case of siderosis bulbi.** *Brit. Jour. Ophth.*, 1946, v. 30, Feb., pp. 85-88.

A soldier complained of pain in a blind eye that had had penetrating trauma a year before. A traumatic cataract and siderosis bulbi were present. A foreign body was removed by means of a magnet through a posterior incision in the sclera. The cataract was removed. After a needling the vision was corrected to 6/12 though the pigment deposits remained.

Morris Kaplan.

Chavany, J. A. **Orbito-temporal osteoma with exophthalmos in syphilis.** *Presse Medicale*, 1945, No. 51, Dec. 22, p. 702.

Chavany reports two cases of exophthalmos in syphilitic patients. In the first patient the exophthalmos was unilateral, of six years duration, and caused by a painless bony mass in the

temporal part of the orbit. Ocular function was normal. The diagnosis of osteoma was confirmed by X-ray examination. All other physical and laboratory findings were negative except for positive Bordet-Wassermann reactions. A diagnosis of syphilis was confirmed by a history of repeated miscarriages. Intensive antisyphilitic therapy with bismuth and potassium iodide failed to influence the eye lesion but did render the serologic reaction negative.

The second patient presented a hard, painless tumor of the left orbito-temporal margin with marked exophthalmos. Radiography showed a condensation of the bone in this area. Symptoms were of three years duration, the onset of the lesions was insidious, and the progression was slow. Physical findings were otherwise normal except for an Argyll-Robertson pupil. Serologic reactions of the blood and spinal fluid were negative but antisyphilitic therapy seemed to be indicated nevertheless.

The author believes that antisyphilitic therapy must be tried but if the lesions progress under therapy the possibility of osseous syphilis is eliminated and surgery is indicated.

Phillips Thygeson.

Gronvall, Herman. A case of chloroma of the orbit with fundus changes. *Acta Ophth.*, 1944, v. 21, pt. 4, pp. 260-266.

The initial symptom of a fatal case of chloroma in a girl five years of age, was a swelling in the right orbit. The child had a displacement of the right eyeball downward and nasally, and ptosis of the lid. The fundus was pale, the vessels bright, wide, and tortuous. The disk margins were obscured and the temporal portion of the disk was pale and surrounded by fine hemor-

rhages. There was a large hemorrhage in the macula and fine hemorrhages in the periphery. The fundus of the left eye presented a similar picture without a macular hemorrhage. The diagnosis was made from the blood picture, and confirmed at autopsy. This disease should be considered in the differential diagnosis of orbital tumors in children. (1 illustration.) Ray D. Daily.

Hinterleitner, K. Tuberculosis of the orbital tissue. *Ophthalmologica*, 1944, v. 108, Oct.-Nov., pp. 210-216.

The author observed two cases of tuberculosis of the orbital tissue. The first patient, a woman 57 years of age, presented a swelling of the lower eye lid, moderate exophthalmus, a hard, indolent mass at the lower orbital margin that spread towards the depth of the orbit and negative X-ray plates. Tuberculin reaction was positive. A biopsy demonstrated tuberculous granulation tissue with giant cells. Treatment by means of Xrays and arsenic lead to improvement. The second patient, a 12-year-old girl, had a slowly growing small mass under the upper orbital rim. The mass was extirpated and found to consist of infiltrates of lymphocytes and epithelioid cells. There was complete recovery without recurrence. The author discusses the literature on primary tuberculosis of the orbit. (Bibliography).

Max Hirschfelder.

MacKenzie, C. M. Choice of grafts for orbital reconstruction. *Amer. Jour. Ophth.*, 1946, v. 29, July, pp. 867-869. (7 figures, references.)

Mann, Ida. Exophthalmic ophthalmoplegia and its relation to thyrotoxicosis. *Amer. Jour. Ophth.*, 1946, v. 29, June, pp. 654-673. (36 figures, 1 table, references.)

Muzzio, J. C. **Orbital complications of sinusitis.** *La Semana Méd.*, 1946, v. 53, April 4, pp. 593-604.

The author relates nine cases. In each case the causal factor was a cold or influenza. Polysinusitis predominated over monosinusitis in the production of orbital complications. Although maxillary involvement is the most frequent form of sinusitis, it and sphenoidal localization produce the smallest number of orbital complications. Acute sinusitis, or reactivation of the chronic condition, will in most cases be adequately treated by medical procedures. If surgical care is necessary, this should at first be limited to drainage of the infected sinus or sinuses. The radical treatment may be postponed for weeks or months after the acute phase has receded or disappeared. (Bibliography.)

W. H. Crisp.

Offret, M. C., and Offret, G. **Malignant exophthalmos in Basedow's disease. Etiologic and therapeutic study.** *Arch. d'Ophth.*, 1945, v. 5, no. 4, p. 429.

The authors define malignant exophthalmos as any exophthalmos, pre- or post-operative, accompanied by a lowering of vision. This drop in visual acuity may arise from such different sources as corneal ulceration or an optic nerve atrophy but the amount of visual loss may be considered a measure of the malignancy of the exophthalmos. Unlike certain American authors they do not consider malignant only those cases in which the exophthalmos persists or is aggravated after thyroidectomy.

According to the authors the frequency of malignant exophthalmos has varied in the different series reported since 1840 when Basedow first noted the progressive character of the exophthalmos and consequent ulceration in

certain cases. At least 100 cases have been reported in the literature; Sattler in 1909 summarized the data on 63 and the present authors did the same for 37. They discuss in turn the pathogenesis, the clinical aspects, the differential diagnosis, the pathologic anatomy, and the treatment of the condition and conclude that malignant exophthalmos in the course of Basedow's disease is an important cause of blindness and that it occurs most often after improvement or healing of the thyrotoxicosis. They consider that diffuse edema of the orbital tissues with hypertrophy of the extraocular muscles is the principal anatomic lesion and refer to the experimental studies which indicate that thyroidectomy plus overaction of the anterior lobe of the pituitary are significant factors. They note that exceptionally malignant exophthalmos can occur as a specific disease in the absence of any thyroid disturbance. They conclude that medical, particularly hormonal, therapy offers the greatest ultimate hope but that at the present time surgical decompression of the orbit, by various methods, is the most important treatment.

Phillips Thygeson.

Peter, A. L. **Oxycephaly associated with Klippel-Feil syndrome and other skeletal defects.** *Amer. Jour. Ophth.*, 1946, v. 29, June, pp. 694-698. (See Section 17, Systemic diseases and parasites.)

Pyeton, W. T., and Simmons, D. R. **Neurofibromatosis with defect in wall of orbit. Report of five cases.** *Arch. Neurol. and Psychiat.*, 1946, v. 55, March, p. 248.

Recklinghausen's disease, neurofibromatosis, is a congenital defect which may affect any part of the body.

It is probably the result of defective germ plasm. Because of the mesenchymal origin of the lesions, it is understandable that many bony defects are associated with the disease. The skull is often the site of changes, not all of which are associated with contiguous tumors.

In the literature 20 cases are reported showing defects in the orbital roof, that allow free communication between the orbit and the intracranial cavity. Five such cases are reported by the authors. All were characterized by exophthalmos, usually of the pulsating type. Some of the patients had skin lesions of neurofibromatosis. Although the diagnosis was not immediately apparent in each case, it was possible to demonstrate roentgenographically an enlargement of the orbit and a defect in the roof. The exophthalmos may be due to (1) orbital neurofibromatosis or a coexisting orbital tumor, or (2) brain tissue in the orbit, producing the pulsations. The proper treatment in the latter instance is repair of the roof of the orbit by transfrontal craniotomy.

Benjamin Milder.

Šmejkal, V. **Injections of 90-percent alcohol in ophthalmology.** *Praktický Lékař*, 1946, v. 26, Feb. 5, pp. 81-82.

Excellent results were obtained with retrobulbar injections of 90-percent ethyl alcohol in 62 patients, under local anesthesia; 0.5 to 1.0 c.c. was injected in patients with spastic entropion or a painful blind eye. O. Felsenfeld.

EYELIDS AND LACRIMAL APPARATUS

Arruga, H. **Penicillin in a grave case of congenital dacryocystitis.** *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Feb., pp. 133-134.

A congenital dacryocystitis with fistula formation, remained without improvement for five days under irrigation, protein injections, and sulfonamides. It cleared up within the next eight days, under irrigation with penicillin. The fistula closed, the lacrimal passages were open, and the epiphora subsided. Ray K. Daily.

Berke, R. N. **Blepharoptosis.** *Arch. of Ophth.*, 1945, v. 34, Nov.-Dec., pp. 434-450.

This is a detailed review of the literature on the etiology, incidence, anatomy, and surgical treatment of ptosis of the upper lid and related defects. An outline is given for the pre-operative study of this condition. The eighty or more operations for ptosis may be divided into three groups: (1) Suspension of the upper lid from the brow, thus utilizing the action of the frontalis muscle for lifting the lid. (2) Attachment of the upper lid to the superior rectus, thereby replacing the action of the levator by the lifting power of the superior rectus. (3) Enhancement of the normal action of the levator by advancing, tucking, or resecting this muscle.

None of these procedures are entirely satisfactory in all cases. As a general rule, resection of the levator palpebrae muscle is the operation of choice when this muscle is not paralyzed. Next in the order of preference is one of the operations which utilizes the superior rectus muscle. If this muscle is weak, the frontalis type of operation is indicated. John C. Long.

Crookes, G. P. **Traumatic blepharospasm as an isolated symptom.** *Brit. M. J.* 1946, no. 4447, March 30, p. 486.

The author reports a case of traumatic reflex blepharospasm of five day

duration in a girl 13 years of age. Blepharospasm was the only finding. Two c.c. of procaine solution was injected at the neck of the mandible and within five minutes all findings disappeared completely. I. E. Gaynon.

Dupuy-Dutemps, P. Obliteration of the lacrimal passages and its treatment. *Ann. d'Ocul.*, 1945, v. 178, June, pp. 242-254.

In burns and injuries of the canaliculi with slight ectropion, canalicular slitting with excision of the conjunctival wall may suffice. In more severe ectropion, autoplasties such as the Kuhnt-Zymanowski procedure are more efficient. In slight infections, especially those that follow blepharoconjunctivitis, dilatation and irrigation may be sufficient. The use of large probes or other methods which traumatize the sac should be avoided because of ultimate cicatrization. In congenital obstruction of the sac the smallest probe will frequently restore potency by puncturing the unabsorbed nasolacrimal membrane. Severe infections in children should be reduced to a minimum. If necessary, the sac should be excised, but if it is at all possible, the operation should be postponed until about the twelfth year of life when a dacryorhinostomy can be performed. In traumatic strictures of all sorts this operation is the procedure of choice. Sac infection secondary to nasal infection is rare. In infective dacryocystitis complicated by corneal ulcer, extirpation of the sac is indicated because convalescence is more rapid. Cauterization of the sac by physical or chemical methods is not advised. Dacryorhinostomy is preferred because of its greater success and permanency. It is contraindicated in the aged and if the nasal mucosa is atrophic or

badly diseased. Physiologic permeability is established in four to six weeks. Chas. A. Bahn.

Frouchtman, R. The etiopathogenesis and treatment of blepharitis. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, March, pp. 173-184.

The study of a group of fifteen patients who had blepharitis leads the author to believe that the affection is a dermatosis localized in the lid borders. The development of the condition is subject to the many factors which contribute to the appearance of the allergic dermapathy. Constitutional predisposition, focal sepsis, the elimination of which is not always followed by cure, digestive factors, endocrine disturbances; hepatic insufficiency, affections of the anterior segment of the eye, mechanical physical and chemical agents, and sensitization to microbes which normally inhabit the skin are factors which the author considers. Sensitization to saprophytic bacteria of the air was shown to be causative in two patients who were cured by the injection of extracts of sarcinae. Several of these factors may be combined to give a complicated etiopathogenesis in any particular case of blepharitis.

J. Wesley McKinney.

Gauffre, R. An operation for congenital coloboma of the upper lid. *Arch. d'Ophth.*, 1945, v. 5, no. 3, p. 342.

The author reviews the operative indications in congenital coloboma of the upper lid and stresses that early operation may be mandatory to protect the exposed cornea. He states that the tissues of infants are particularly fragile and do not react well to traction or constriction and do not hold sutures well. In an effort to avoid complications arising from this tissue fragility

he employed akinesis with a solution of 40 percent alcohol to eliminate lid spasm and used warm saline dressings, changed every two hours, to minimize tissue swelling. Phillips Thygeson.

Gronvall, Herman. **On argyrosis and concretion in the lacrimal sac.** *Acta Ophth.*, 1944, v. 21, pt. 4, pp. 247-259.

A review of the literature is followed by a detailed report of two cases. In one of the patients a hard, black dacryolite was found. The interesting feature was the difference in the histologic picture of the sacs. In this first case, the pigment was found on the elastic fibres and in the inflammatory tissue. In the second case, the pigment was deposited in the basal membrane of the epithelium and in the star-shaped connective tissue underneath. Ultra-violet spectral analysis of the dacryolite revealed the following constituents: Ca, Ag, Mg, Fe, P, Al, Cu, Na, and possibly Si. (4 illustrations.) Ray K. Daily.

Iribas, Gregorio. **Adrenalin in narrowing of the lacrimal passageways.** *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, March, pp. 206-207.

The author cites the advantage of the use of adrenalin to shrink the mucosa before probing for stenosis of the nasolacrimal duct.

J. Wesley McKinney.

Lutman, F. C., and Favata, B. V. **Keratoconjunctivitis sicca and buccoglossopharyngitis sicca with enlargement of parotid glands.** *Arch. of Ophth.*, 1946, v. 35, March, pp. 227-240.

Sjögren, in 1933, described a chronic disorder characterized by reduction in the secretions of the lacrimal and salivary glands with accompanying keratoconjunctivitis sicca, and dryness of

the mucous membranes of the mouth and the upper respiratory system. A persistent enlargement of the parotid glands sometimes occurred. The several publications of Sjögren on this subject have established the condition as a syndrome that now bears his name.

The numerous complications in the development of this disease do not occur in every patient, but the high incidence of each warrants the belief that they involve many of the body's systems, and that the ocular manifestations are but a part. In the presence of a chronic inflammation of the lacrimal gland, the forms of local treatment that have been suggested must be considered of no more than palliative value.

Two cases of Sjögren's syndrome are reported in detail. The microscopic pathologic changes in a lacrimal gland and the parotid glands in one case are described. Some of the complications and possible causes of this disease are discussed. A clinical resemblance to advanced chronic ariboflavinosis is noted. R. W. Danielson.

Lyle, T. K., Cross, A. G., Simpson, J. F. **Dacryo-cysto-rhinostomy.** *Brit. Jour. Ophth.*, 1946, v. 30, Feb., pp. 102-119.

Fifty cases of dacryo-cysto-rhinostomy are analysed and the results found to be uniformly satisfactory. The operation, which is much like the Toti-Moser procedure except that the skin incision is placed more anteriorly, is described in detail with the help of good diagrams. Lipiodol injection for X-ray study and a careful nasal examination are always done before surgery. General anesthesia is preferred. The authors believe that a simple excision of the sac is entirely insufficient. The surgical cooperation of an ophthalmol-

ogist and a rhinologist is strongly urged. The only contraindications to the operation are definite absence of the sac and irreparable obstruction of the lower canaliculus. (7 illustrations).

Morris Kaplan.

Niemeyer, Waldemar. Autoplastic dacryorhinostomy. *Arquivos Brasileiros de Oft.*, 1945, v. 8, Dec., pp. 181-185.

The technique described was first published by the author at the second Argentina Congress of Ophthalmology in 1940.

After the usual preparation, the nasal bone is trephined, the opening being beveled so as to make it larger toward the nasal fossa. With a Deschamps hook or other instrument, a silk thread number 2 or 3, more or less 20 to 25 cm. long, is passed through the slit lower canaliculus and the bony gap, and is brought out through the corresponding nasal passage. A flap of labial or buccal mucosa is prepared, measuring (after dissecting away the fatty tissue) 12 to 14 mm. in length by 12 mm. at the base and 10 mm. at the upper side (slightly trapezoid form).

With three stitches of fine chromic catgut, this flap is sutured in its length to form a sort of sleeve, with the raw surface outside. The silk thread which served as a guide is pushed into the nasal extremity of the tube so as to hold the flap in its definite position, the proximal end being united to the distal extremity of the canaliculus. A small chromic catgut suture is sufficient to fix the proximal extremity of the new canal to the distal extremity of the canaliculus. Care must be taken to make the periosteal resection larger than the bony opening; and also to avoid leaving a bony fragment in the

canal. The tube of mucosa should not be longer than necessary for good union between the end of the canaliculus and the mucosa. Good hemostasis is desirable. (10 figures.)

W. H. Crisp.

Turtz, C. A. Use of penicillin in acute dacryocystitis. *Amer. Jour. Ophth.*, 1946, v. 29, June, pp. 723-725.

15

TUMORS

Godtfredsen, Erik. Eye and nerve symptoms in connection with cranial chordomas. *Acta Ophth.*, 1943, v. 21, pt. 3, pp. 224-236.

The literature which contains 24 reports of cases is briefly reviewed and a case is reported. The initial symptom in the 57 year-old man was unilateral impairment of hearing, followed three years later by abducens paralysis and trigeminal neuralgia. The patient died three and one-half years after the onset of symptoms, and the autopsy revealed a diffuse destruction of the base of the skull and liver metastases. The diagnosis of these tumors is very difficult, and the first symptom frequently results from involvement of the ocular nerves. A diagnosis is possible only in chordomas that proliferate into the naso-pharynx and are accessible to biopsy. (Illustration.) Ray K. Daily.

Lisa, J. R., and Givner, I. Melanoma of the skin with intraocular and orbital metastases. *Arch. of Ophth.*, 1945, v. 34, Nov.-Dec., pp. 422-424.

Melanoma of the eyes or orbits is usually a primary disease and seldom occurs as a metastasis. The authors report a case of metastasis from a primary tumor of the posterior chest wall. Innumerable masses of tumor were found scattered over the body.

At autopsy widespread metastases were found in all the organs except the testes and the left epididymis. There were very numerous tumors in the brain. In each eye there was retinal detachment due to choroidal metastases. Orbital masses were also present. (5 photomicrographs.)

John C. Long.

Mathewson, W. R. **Meningioma of the tuberculum sellae with bitemporal hemianopia.** Brit. Jour. Ophth., 1946, v. 30, Feb., p. 92-102.

A patient with a prechiasmal meningioma and irregular bitemporal hemianopia is described. At operation a very irregular growth of the tumor was found which was the basis of the irregular perimetric findings. Despite some obvious optic atrophy, the patient made a very satisfactory recovery. (10 field charts).

Morris Kaplan.

Páez Allende, Francisco. **Recklinghausen's disease (neurofibromatosis of bulbar conjunctiva).** La Semana Méd., 1946, v. 53, March 28, pp. 572-579.

The patient was a female twin aged 18 years. There was a large tumor formation of the bulbar conjunctiva, histologic analysis of which showed neurofibroma. The patient showed also bodily asymmetry, cutaneous tumors, partial alopecia of the hairy scalp on the side of the affected eye, skeletal lesions, intracranial involvement, and epilepsy. It was planned to extirpate the conjunctival tumor, with insertion of buccal mucosa to fill the breach thus left in the conjunctiva. (7 figures, bibliography.)

W. H. Crisp.

Skydsgaard, Hénning. **Benign rhinopharyngeal tumor (meningioma) with eye symptoms of intracranial origin.**

Acta Ophth., 1944, v. 21, pt. 4, pp. 287-294.

A man, 57 years of age, developed amaurosis with papillary atrophy in the right eye, and a loss of light reaction in the left eye, within a period of ten weeks. A diagnosis of retrobulbar neuritis was made. Ten months later total ophthalmoplegia set in in the right eye, and the visual acuity of the left eye became impaired. Three months later a temporal quadrant hemianopsia for red was found in the left eye, and the ophthalmoplegia cleared up. At this time X-ray studies of the skull were suggestive of sclerosis of the internal carotid. Nasal obstruction led to a rhinological examination 17 months after the onset of the visual difficulties and a naso-pharyngeal tumor as large as a plum was found and removed. The microscopic diagnosis was meningioma. Nine months after removal of the tumor the ocular condition was unchanged.

Ray K. Daily

16

INJURIES

Dwek, Joseph. **Ecchymotic mask.** J. Internat. Coll. Surgeons, 1946, vol. 9, March-April, pp. 257-265.

Ecchymotic mask is a syndrome that develops after traumatic compression of the chest and abdomen, and is characterized by a cyanotic discoloration of the skin of the face, neck, upper part of the chest, and of the conjunctiva. The lids are edematous. A triangular subconjunctival hemorrhage with the base toward the caruncle and its apex toward the pupil is visible in the palpebral opening. Exophthalmus is present and results from intraorbital hematoma. Mydriasis may be found with a loss of pupillary reaction to

light. Compression of the optic nerve may lead to loss of light perception. Retinal hemorrhages usually lead to atrophy of the disc. Vitreous hemorrhages have been reported.

I. E. Gaynon.

Haik, G. M. The management of intraocular foreign bodies in military practice. *Amer. Jour. Ophth.*, 1946, v. 29, July, pp. 815-825. (6 figures, 1 table, references.)

Paviscic, Z. Early transplantation of mucous membrane from the mouth and conjunctiva in burns of the eye. *Ophthalmologica*, 1944, v. 108, Dec., pp. 297-304. (See Section 5, Conjunctiva.)

Porcher, P. and Gilles, E. A method of localizing opaque intraocular foreign bodies. *Ann. d'Ocul.*, 1945, v. 178, Aug., pp. 345-357.

Six roentgenograms are taken of the eye in the following positions; forward, right, left, up, down, and two oblique. For these exposures two films, 6 by 15 inches, are used. The apparatus consists essentially of a localizing tube which contains a plexiglass aluminum-coated mirror observation tube. Attached to it is a metal plate with a thumb screw for raising or lowering a lead ring 24 mm. in diameter, which is contained in a plastic holder. A wire with a long and short arm which shows the position of the eye on the plate projects through a hole exactly in the center of the lead circle. The long arm is attached to an elastic cord which corresponds with the patient's line of fixation. The patient's head is firmly fixed in a holder and the apparatus contains a plate which rests against the nasal wall of the orbit. The basic principle

involved is a triangulation of the lead circle, the wire meridian line of fixation and the intraocular foreign body. The author claims that the results obtained with this method compare favorably with the more complicated Sweet and other methods. Chas. A. Bahn.

Prado, Durval. Strange ocular complication caused from intoxication by sulfadiazine. *Arquivos Brasileiros de Oft.*, 1945, v. 8, Dec., pp. 169-172. (See Section 5, Conjunctiva.)

Saint-Martin, R. A new case of bi-temporal traumatic hemianopsia. *Ophthalmologica*, 1943, v. 105, June, pp. 290-298.

The author describes a case of bi-temporal traumatic hemianopsia with considerable contraction of the nasal portion of the fields which occurred after a fracture of the left frontal bone. The patient, who was examined 11 months after the accident, had a distinct atrophy of the optic nerve and pallor of the nasal segment of the disk of the right eye. There also existed a complete anosmia and an anesthesia of the skin in the region of the right external nasal nerve. The X-ray picture showed a lesion of the left frontal bone at the level of the left minor ring of the sphenoid.

Posttraumatic bitemporal hemianopsias are rare therefore the author briefly reviews the literature and discusses the theories and experiments concerning the mechanism of these injuries. (References.)

Alice R. Deutsch.

Stewart, F. J., Plastic artificial eyes. *Proc. Roy. Soc. Med.*, 1946, v. 39, March, p. 251.

The author feels that mass-produced

plastic ocular prostheses are adequate in the average socket. Despite the occasional idiosyncrasy to methyl methacrylate (one in 10,000), and the ease with which these eyes are scratched, they are distinctly better than glass eyes. Experiments are in progress on hardening the plastic surface.

Benjamin Milder.

Thüer, E. Examination of a bulbus after caterpillar hair injury. *Klin. M. f. Augenh.*, v. 109, May-June, 1943, p. 350.

Injuries from caterpillar hair especially from specimens of the Bombyx and Euproctis families are always a serious and not infrequent occurrence. Thüer reports six cases observed in the Zürich University Eye Hospital. In the most favorable case the patient was admitted to the hospital three days after the injury; the eye recovered in six weeks without recurrences even though all of the hair could not be removed. The lesion was accompanied by the formation of vesicles in the cornea. In all other cases the posterior portions of the globe were involved. The caterpillar hair, which consists of chitin and has minute sharp barbed hooks, wanders into deeper tissues and causes not only mechanical but also toxic damage. The inflammatory process flares up at intervals that varied from 1½ up to 18 years. In no case was removal of all hairs possible. Those embedded in the conjunctiva were removed by means of forceps or excision. Once an iridectomy was performed. In four eyes considerable loss of vision resulted, and two were enucleated. In five of the six cases the injury was a result of youthful frivolity; only one could be regarded as an industrial accident. One

eyeball was examined histologically in serial sections. In 54 nodules 61 fragments of hair were found distributed in the conjunctiva, sclera, iris, ciliary body, vitreous body, choroid, and optic disc. Caseation, as in tuberculosis, was not found in any of the nodules. Giant cells were not frequent and usually had their nuclei peripherally placed. Signs of absorption were noted but rarely. In only three of the 54 nodules were no fragments of hair found. (4 microphotographs, references.)

F. Nelson.

17

SYSTEMIC DISEASES AND PARASITES

Bailliant, P. Clinical aspect of ocular tuberculosis. *Ann. d'Ocul.*, 1945, v. 178, Nov., pp. 469-489.

Ocular tuberculosis is an affection of adolescence and more often occurs in boys. Primary infection is rare, its prognosis is often favorable, and it is best treated by means of thermocautery, tuberculin, and radiotherapy. In animals secondary glandular involvement from conjunctival infection may occur without a visible primary conjunctival lesion. Ocular infection secondary to a lacrimal lesion that has extended from the nose is rare. Ocular tuberculomas frequently involve the anterior portion of the uvea; often they are highly inflammatory and vascular, clinically resemble sarcoma, and not infrequently necessitate prompt enucleation. A milder form, nodular iritis, is only slightly inflammatory. Miliary tuberculosis which is due to a bacillema, occurs in the uvea and retina, and varies widely in its severity and duration. This variation depends not only

on the quantity and virulence of the organisms but also on ocular and extraocular allergy. Intraocular infection may extend to the meninges. Phlyctenular keratoconjunctivitis is essentially an allergic reaction which may be accompanied by secondary infection, is usually bilateral, and occurs most frequently in infancy and puberty. Basically, it is an impetigo caused by an antigen that is most frequently tuberculous, and less frequently originates in other organisms, fats or horse serum. The offending antigens are probably secreted in the tears. Tuberculous episcleritis, sclerokeratitis, and interstitial keratitis are also usually allergic reactions, but of longer duration, and recovery is often incomplete. This is especially true of the deep type of scleritis. Among intraocular conditions which pathologically resemble tuberculous lesions are retinal periphlebitis with vitreous hemorrhages, retinal angiomas, Coats' disease, and the syndromes of Heerfordt and Besnier-Bock. Among the diagnostic features noted in tuberculous iridocyclitis are nodules, large gray precipitates, a slow course, folliculosis, lymphocytosis, cicatrization, and incomplete healing. Pigmentation is less marked in tuberculous choroidal lesions than in those caused by syphilis. Pin point granulations in miliary lesions are diagnostically suggestive, as is a dirty gray color. Tuberculosis in antecedents and associates often affords a diagnostic clue. Calcified pulmonary glands, especially those with cloudy margins, may be evidence of slight activity. The uveal tract is especially sensitive to involvement from slight extraocular tuberculous disease. Tuberculous patients usually have vascular hypotension. Unfortunately tu-

berculotoxins have not been identified in the blood.

In hospitals and sanatoria for the tuberculous, ocular tuberculosis is very rare, and its severity is roughly inversely proportionate to the severity of the extraocular lesions. This apparent antagonism of local and general tuberculosis exists in 60 percent of patients with ocular tuberculosis. The stages of tuberculosis are frequently correlated with characteristic ocular manifestations; in the primary or infective stage with phlyctenular disease; in the secondary stage recurrent phlyctenular keratitis, deep keratitis, scleritis, and especially uveal inflammations. In the tertiary stage in which the basic foci of the disease are walled off ocular involvement is rare. Chas. A. Bahn.

Cockburn, C. Ocular cysticercus celulosae. Brit. Jour. Ophth., 1946, v. 30, Feb., pp. 65-74.

The patient was a Jugo-Slav in a British hospital in Italy who complained of defective vision in the right eye. This consisted of a gray haze for about six weeks, then suddenly a well defined object "shaped like a pear leaf" became noticeable. It possessed a stem which had a knob at its end and constantly changed its position "like a serpent's head searching for something." The patient made several drawings of his visual impression that are amazingly accurate pictures of the parasite found. Under atropine mydriasis the entopic image was reduced almost half in size.

Examination revealed a completely spherical, brilliantly colored cyst in the lower portion of the very fluid vitreous to which a miniature tapeworm complete with scolex possessing hooks and suction discs was attached. The head

moved about constantly. Nearby was an area of acute choroiditis through which the cyst had apparently ruptured though no retinal separation was present.

The cyst was delivered with the aid of a scleral hook through a scleral section. There was considerable loss of fluid vitreous. After a stormy convalescence the eye became quiet and perceived light. The parasite was *taenia solium*. No adult infestation was present in this man. The ovum apparently had been swallowed, had penetrated the intestinal wall and entered the portal circulation, the arterial system, and finally the choroid by way of the ophthalmic artery. Morris Kaplan.

Desvignes, P. Aneurysms of the intracranial segment of the internal carotid. *Arch. d'Opht.*, 1945, v. 5, no. 3, p. 303.

This comprehensive review with illustrative case reports is difficult to abstract. The author stresses the fact that ocular symptoms commonly bring this condition to the attention of the ophthalmologist, upon whom rests the burden of early diagnosis, although treatment is necessarily neurosurgical. He also stresses the important role that cerebral arteriography plays in the diagnosis.

Important points discussed include (1) anatomical variations of the carotid, (2) clinical signs of aneurysm including ophthalmoplegia, meningeal hemorrhage, and opticochiasmic compression, all illustrated by case reports, (3) evolution, and (4) therapy. The author discusses in detail the various eye signs and mentions that a progressive exophthalmos which can be pulsating in type may occur in certain cases. Radiography generally shows

erosions of the anterior clinoid processes and abnormal vascular shadows with or without arterial calcification.

Focal symptoms depend upon the anatomical localization of the aneurysm. If it is in the cavernous sinus, unilateral loss in visual acuity, diplopia, unilateral headaches, facial neuralgias, corneal anaesthesia, and sometimes slight exophthalmos may result. If the aneurysm ruptures, the characteristic picture of arterio-venous aneurysm with pulsating exophthalmos may result. If the aneurysm is localized at the termination of the internal carotid, or on one of its terminal branches, there may be violent retro-orbital headaches, sometimes with vomiting and loss of consciousness. Sudden death is the usual end result. If the aneurysm produces a compression of the chiasm, unilateral loss in visual acuity is the common symptom but bitemporal hemianopsia may supervene. If the lesion is left untreated blindness results.

Possibilities of medical treatment are discussed, including injection of sclerosing solutions, but surgical therapy offers more hope. Pulsating exophthalmos in particular has been successfully treated by carotid ligation and the author considers this procedure as life saving in the prevention of aneurysmal rupture. Internal carotid ligature is useless, however, when the terminal branches of the artery are involved, and direct surgical intervention may be necessary. Phillips Thygeson.

Falls, H. F., and Beall, J. G. Ocular varicella. *Arch. of Ophth.*, 1945, v. 34, Nov.-Dec., pp. 411-412. (See Section 6, Cornea and sclera.)

Gördüren, Süreyya. A case of acro-

cephaly. Göz Klinigi, 1946, v. 3, no. 4, pp. 53-62.

The writer describes a young patient who had been suffering from acrocephaly, nystagmus, exophthalmos, divergent strabismus, and a primary atrophy of the optic nerve.

A projection on the occipital region of the skull, as large as a goose's egg, accompanied the acrocephalic change. It is assumed that the closure of the lambdoidal suture was retarded in consequence of which the skull, having no resistance against the intracranial pressure, became malformed.

An accompanying anosmia may have been caused by pressure on the olfactory nerve or as a result of a specific meningitis or a pachymeningitis. The Wassermann reaction of the blood was three plus. I. E. Gaynon.

Kayser, B. Distant effect on both eyes originating from a focus in the mandible with unilateral hemianopsia. (Self-observation.) Klin. M. f. Augenh., 1943, v. 109, May-June, p. 413.

Kayser noticed a horizontal unilateral hemianopsia developing slowly and insiduously in his hitherto normal and not irritated left eye. The scotoma was absolute and objective but did not interfere much with vision since the macula was not affected, but a pulsation synchronous with the heart beat was present in the eye. Two weeks later there was sudden malaise, great fatigue, and severe bilateral disturbance of the function of the eyes. Reading, writing, and fusion became impossible. The supraorbital rim and region of the frontal sinus were tender to touch. He had vertigo and light-headedness and his gait became spastic. Internal and rhinological examinations were negative. Bed rest gave no

noticeable relief. Two months later a sore tooth in the lower jaw was treated for granuloma. The symptoms disappeared rapidly. F. Nelson.

Öztürk, M. H. A case of Behçet's disease. Ophthalmologica, 1944, v. 108, Dec., pp. 288-292.

Behçet's disease is a complex of symptoms characterized by aphthous ulcers in the mouth, ulcerations on the genitals, erythematous nodules on the legs (erythema nodosum), and by keratitis, iritis, and hypopyon in the eye. These changes do not always occur concurrently, but may be separated by months or even years. Behçet who described the disease a few years ago assumed that a virus is the causal agent. The author describes a patient, observed in Istanbul, who gave a history of attacks of fever and ulcerations in the mouth and on the genitals. The eye symptoms occurred later with edema and opacification of the cornea, hypopyon, later hyphema, and secondary glaucoma. Only one eye was involved and the symptoms varied in intensity from time to time. Phlebitis and erythema of the legs were also present. Treatment with sulfonamides and vitamins B and C was unsatisfactory. Max Hirschfelder.

Peter, A. L. Oxycephaly associated with Klippel-Feil syndrome and other skeletal defects. Amer. Jour. Ophth., 1946, v. 29, June, pp. 685-693. (18 figures, references.)

Siniscal, A. A. Oculoglandular tularemia. Amer. Jour. Ophth., 1946, v. 29, June, pp. 698-710. (See Section 5, Conjunctiva.)

Steenken, W. Jr., Wolinsky, E., and

Heise, F. H. Treatment of experimental ocular tuberculosis with promin. *Am. Rev. Tuberc.*, 1946, v. 53, Feb., p. 175.

In order to evaluate the therapeutic effect of promin (a derivative of diamino-diphenyl-sulfone) on tuberculosis, the authors employed direct clinical observation of tuberculous lesions of the eye. Suspensions of tubercle bacilli were injected into the anterior chamber of the eyes of guinea pig. The resulting infection was graded into five groups according to severity of the findings.

One group of vaccinated guinea pigs in whom tuberculous ocular infection had been produced was treated with promin administered orally, while another group received the drug orally and locally (by instillation into the conjunctival sac). In both these groups, there was an initial allergic response, followed by improvement for one week, then a gradual increase in severity to grade 3 infection. Similarly infected vaccinated guinea pigs, that did not receive promin, were found to have more severe ocular infection (grade 4). Control animals that had not been vaccinated beforehand with tubercle bacilli, and had not received promin, developed a grade 5 reaction (corneal necrosis and perforation), and died.

The experiment demonstrated that promin was of value early in the course of tuberculosis, as evidenced by the clinical observations and corroborated by the autopsy findings at the conclusion of the 295-day experiment. No cures were effected but there was a definite retardation of the tuberculous lesions. Benjamin Milder.

Toledo, Renato de. Ocular manifes-

tations of the avitaminoses. *Arquivos Brasileiros de Oft.*, 1945, v. 8, Dec., pp. 173-180.

A general review of this subject under the headings of avitaminosis A, light sensibility and adaptation to dark, complex B, vitamin C, vitamin D, and vitamins E and K.

W. H. Crisp.

Vanýsek, J. Conjunctivo-urethrosynovial syndrome of Feissinger and Leroy or Reiter's disease. *Časopis Lékařů Českých*, 1946, v. 85, March 15, pp. 343-347. (See Section 5, Conjunctiva.)

18

HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Barnett Albert. Plato's conceptions of light and sight. *The Optician*, 1946, v. 111, May 10, pp. 289-292.

The article consists of quotations from the "Republic." Plato gives many examples of what we today would call the phenomena of light and dark adaptation, and states "that the bewilderments of the eyes are of two kinds, and arise from two causes either coming out of light, or from going into the light." In Book X, Plato discusses the refracting property of water because of which an object that appears straight when looked at out of the water seems broken when in the water. In the discussion of visual beams, sight is an internal fire that flows from the eyes in a smooth and dense stream and passes through the pure element. When this combines with external light, the stream of vision reaches the soul and causes that perception called sight. He also discusses reflection and the formation of images in mirrors.

Colors are a flame which emanates from any part of the body and has particles corresponding to the sense of sight. Particles having the same size as sight are transparent. White dilates the visual ray and black contracts it. The formation of colors is discussed as caused by the various fires, the proportions of which give the various hues. There is an intermediate hue of red. Red and white make auburn. Red, white, and black make purple.

I. E. Gaynon.

Bonhomme, E., and Agatston, H. Belgian ophthalmology during the war. *Amer. Jour. Ophth.*, 1946, v. 29, June, pp. 674-684. (1 table, references.)

Fortner, E. N. A Public School program for the visually handicapped in Oregon. *Sight-Saving Review*, 1945, v. 15, Winter, pp. 212-220.

School teachers are trained to test vision by means of the Snellen chart. All children whose visual acuity is 20/40 or less, or who have asthenopia or strabismus, are referred to their family doctor or to a clinic. The Division of Special Education provides textbooks with clear type where needed. During the past two years 2700 children have been examined in the educational clinics, and 150 of them have needed books with large type. I. E. Gaynon.

Hilliard, R. Public assistance for the blind in Illinois. *Illinois M. J.*, 1945, v. 88, Oct., p. 199.

The Illinois Public Aid Commission has had the responsibility for the administration of the Blind Assistance Act since its passage in June of 1943. This act provides assistance to needy blind persons and its provisions are

such that Social Security funds are made available to meet 50 percent of the cost up to a maximum of \$40.00 per month.

A committee was appointed to advise on the social and medical aspects of the program.

The definition of blindness formulated by the Sub-committee on Ophthalmology reads as follows: "In terms of ophthalmic measurement, central visual acuity of 20/200 or less in the better eye, with correcting glasses, is generally considered economic blindness. A field loss in which the visual field efficiency is reduced to 30 percent or less may be considered equally disabling, as may certain ocular conditions which do not necessarily involve visual acuity or peripheral field loss, but which constitute severe visual handicaps."

The applicant must furnish evidence of financial need, verification of age, and proof of blindness. The applicant must have reached the age of 18 years and must be examined by an ophthalmologist.

The examiner reports his findings on a form which the Commission supplies and mails it to the Supervising Ophthalmologist who reviews and evaluates the findings in terms of the definition before he certifies that the applicant is blind.

The assistance is not always financial. The applicant may be given medical care or help in social and economic rehabilitation.

The Commission has worked out cooperative agreements with the Division of Visitation of the Adult Blind; Division of Vocational Rehabilitation; Illinois Eye and Ear Infirmary; Cook County Hospital; the sheltered workshop of the Department of Public Wel-

fare; Trachoma Clinics; and many private social and welfare agencies.

Theodore M. Shapira.

Jones, Tom. *Via optica*. Quart. Bull. Northwestern Univ. Med. School, 1946, v. 20, Spring, pp. 71-76.

The writer has been concerned for years with the production of visual teaching media and thinks one should exploit this method of communication of knowledge and information. We are still clinging to the traditional lecture hall methods; experience has shown that these methods are insufficient and time consuming as compared to the newer visual and audio-visual technique which can be integrated towards a fuller and more lasting understanding. Models, charts, photographs, drawings and all worthy graphic material should be kept displayed in classrooms, halls, or wherever suitable space permits. The growth of visual education has imposed upon the planners of our medical schools the need for providing space for the function of the graphic media of medical education and for providing facilities for the expression of the language of vision. Students' capacity of absorption varies. Some require more time than others to comprehend and coördinate the material of their course. A variety of well selected visual aids placed where they can be seen becomes an environmental factor which silently and unobtrusively contributes to their wider understanding. Students like to visit these interesting places where they can solidify and expand their class-room studies; they are grateful for the opportunity to observe and contemplate at leisure material that will supplement and illuminate what they learn in the class-room and laboratory. Two figures ac-

company the essay which illustrate some aspects of visual instruction.

Melchior Lombardo.

Knudtzon, Kartsen. *Social-medical experiences from the school for children with defective vision in Copenhagen*. Acta Ophth., 1940, v. 20, pt. 2, pp. 194-204.

These data are compiled in the hope that the information may be helpful to a committee that is at work to expand the program. A statutory provision for special education for all handicapped children becomes effective in April, 1948.

Ray K. Daily

Lee, O. S. *Chinese native ophthalmology*. J. Iowa M. Soc., 1946, v. 36, March, pp. 91-98.

This paper covering the history and conceptions of Chinese ophthalmology is not suitable for condensation. Some of the more striking data follow. Needling was supposedly originated in 2679 B.C., and the first work on this subject was published in 250 B.C. Through the influence of Buddhism, Indian medicine was introduced into China. The three main texts of the era included a description of conjunctivitis, cataract, night blindness, glaucoma, trichiasis and operation for cataract.

The Chinese concept of the functions of the organs of the body and their ideas on the principles and practice of medicine are based on the theory of cosmogony, which is active today. There is no literature dealing with the anatomy of the eye. Ocular disease is always associated with disease of the viscera and internal organs. Diseases of the eye are divided into diseases of the internal eye, of the external eye, and of the corneal membrane. The causes and treatment of pterygium,

hypermetropia, trachoma, redevye, glaucoma, pannus, iris prolapse, interstitial keratitis, trichiasis, blepharitis are illuminated from the Chinese point of view. The surgery for pterygium and cataract, and optical glass came into use between 1766-140 B.C. The notation for the refractive power of lenses was not in diopters, but according to the Chinese zodiac. Plus lenses were used only for presbyopia. They were not prescribed for the young even if needed, for the young did not dare to use the same lenses as their elders.

I. E. Gaynon.

Podestà, H. The psychophysical foundations of the Aristotelian doctrine of the sense perceptions with special regard to the sense of vision. *Klin. M. f. Augenh.*, 1943, v. 109, Jan.-Feb., pp. 108-118 and March-April, pp. 253-265.

The author presents a very elaborate and interesting historical treatise on the philosophical development and structure of Aristotle's doctrines of sensual processes.

F. Nelson.

Stock, F. E. Blindness in an urban center in Nigeria. *Brit. M. J.*, 1946, April 6, pp. 525-526.

A census of the blind was made in the town of Yerwa in September 1944. Among 35,000 persons there were 497 cases of blindness. Of all persons 37 percent became blind before the age of 10 years.

Of 254 persons examined, 103 were made blind by smallpox. Conjunctivitis (keratomalacia due to vitamin A deficiency) is very common. Leucoma and panophthalmitis were the cause of 103 cases of blindness. About two per-

cent of the population is blind and four fifths of the blindness could have been prevented by compulsory vaccination and an adequate diet. I. E. Gaynon.

Voisin, J. The ophthalmologist and the present laws relating to military pensions. *Arch. d'Ophth.*, 1945, v. 5, no. 3, p. 332.

This report deals with the relationship of the ophthalmologist to the French pension laws of 31 March, 1919, and the modifications of 1919, 1941, and 1942. There is a brief outline of those laws which concern service-connected eye lesions.

Phillips Thygeson.

19

ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Gronvall, Herman. Two cases of Draganesco's cutaneo-auricular reflex. *Acta Ophth.*, 1944, v. 21, pt. 4, pp. 267-270.

In 1929 Draganesco described a reflex that is characterized by a lifting of the auricle in response to mechanical stimulation of the skin about the ear, or half of the face or head. It is normal in rabbits, and is considered a phylogenetic relic in man. Gronvall describes two patients in whom this reflex could be elicited principally from the skin about the orbit.

Ray K. Daily.

Rønne, Henning. The structure of the human visual pathway. *Acta Ophth.*, 1943, v. 21, pt 3, pp. 137-190.

This is a compilation of published material, gathering the scattered data into a monograph. (22 illustrations.)

Ray K. Daily.

NEWS ITEMS

Edited by DONALD J. LYLE, M.D.

904 Carew Tower, Cincinnati 2

News items should reach the editor by the twelfth of the month

DEATHS

Dr. James Cornelius Braswell, Tulsa, Oklahoma, died May 31, 1946, aged 53 years.

Dr. Grady Edward Clay, Atlanta, Georgia, died July 11, 1946, aged 56 years.

Dr. Robert Lewis Crockett, Oneida, New York, died May 27, 1946, aged 70 years.

Dr. Edward Keith Ellis, Boston, Massachusetts, died June 7, 1946, aged 66 years.

Dr. Frederick James O'Conner, Fayetteville, New York, died March 29, 1946, aged 62 years.

MISCELLANEOUS

The National Society for the Prevention of Blindness announces a three-day conference, November 25, 26, and 27, 1946, at the Hotel Pennsylvania, New York.

During September and October, a series of meetings are being held in the Department of Ophthalmology, University of Glasgow. The general arrangements are similar to those for the series held a year ago. The program includes: On September 11th a paper on "Irregular dominance in hereditary nystagmus," by Prof. W. J. B. Riddell; on September 18th, a paper entitled "Etiology and treatment of paralytic squint," by Dr. W. O. G. Taylor.

Dr. J. B. Gaylor will speak on September 25th. His paper is on "Electroencephalography in retinal disease." On October 2d, Mr. John Foster will present a paper entitled "An ophthalmic tour of Switzerland." Dr. Michaelson will discuss "Proptosis and exophthalmos" on October 9th, and on October 16th, Professor Loewenstein will give a paper on "Phakomatosis."

The meetings are open to all medical practitioners and senior students interested in ophthalmology. Tea is served after the paper has been read, and a discussion follows.

A unit has been established to administer the new New York State ophthalmic law requiring, for the first time, the licensing of persons engaged in dispensing eyeglasses, spectacles, and lenses, according to the department of education in the New York Times, July 15th. The new unit is in the department's bureau of qualifying certificates and professional examinations. The commissioner of education has appointed an advisory board to assist in administering the law, consisting of: Dr. Walter

Hipp, ophthalmologist, 140 East Fifty-Fourth Street, New York; Harlow Fuller, optometrist, Syracuse; Henry B. Carpenter, optician, Guild of Prescription Opticians of America, Inc., Syracuse; Edward J. Boyes, optician, 659 Lexington Avenue, New York; Walter A. Blocker, optician, 604 Madison Avenue, New York.

Persons engaged in ophthalmic dispensing must be licensed by July 1, 1947. Those who have been engaged in ophthalmic dispensing for three years before enactment of the law, April 10, 1946, may qualify for licenses by submitting evidence that they were thus principally engaged in the state for at least that period and evidence of good moral character. The period of filing is extended beyond July 1, 1947, for war veterans who were ophthalmic dispensers for not less than three years before they entered the armed forces. After July 1, 1947, a candidate for the required examination must present evidence of an approved secondary school course and the completion of either a one-year course of study in a school of ophthalmic dispensing registered by the state education department or one year of training or experience in ophthalmic dispensing under the supervision of an ophthalmic dispenser, physician, or optometrist. Thus far no schools of ophthalmic dispensing have been registered with the department, it is reported.

SOCIETIES

At a recent meeting of the Pennsylvania Academy of Ophthalmology and Otolaryngology, Dr. Thomas F. Furlong, Jr., Ardmore, was elected president. Among other officers are: Dr. Benjamin F. Souders, Reading, secretary, and Dr. William E. Grove, Johnstown, treasurer. The 1947 meeting of the society will be at the Hotel Hershey, Hershey, in April.

PERSONALS

Dr. Bertha A. Klien has been appointed associate professor of ophthalmology at Northwestern University Medical School. She has been serving as associate professor of ophthalmology at the University of Illinois College of Medicine.

Dr. James N. Greear, Jr., 1740 M. Street, N.W., Washington, D.C., has been named as consultant in ophthalmology to the Secretary of War.

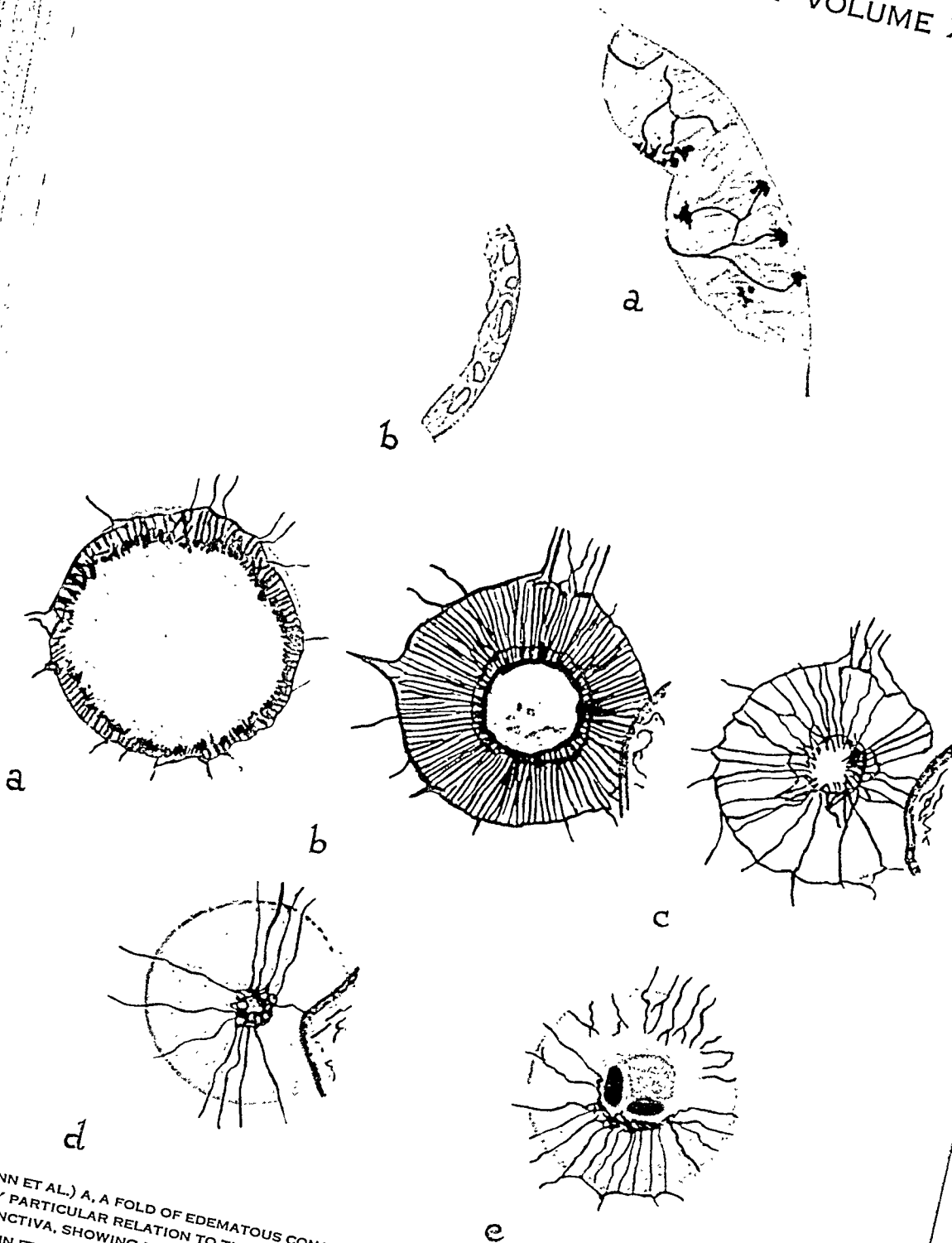


FIG. 9 (MANN ET AL.) A, A FOLD OF EDEMATOUS CONJUNCTIVA SHOWING DILATED LYMPHATICS AS FLAT PALE BANDS NOT IN ANY PARTICULAR RELATION TO THE CAPILLARIES (WHICH SHOW PETECHIAE). B, OPTICAL SECTION OF SWOLLEN CONJUNCTIVA, SHOWING LYMPHATICS AS OPTICALLY EMPTY FLAT OVAL TUBES.

FIG. 10 (MANN ET AL.) STAGES IN VASCULARIZATION AND DESTRUCTION: A, VESSELS INVADING EDEMATOUS CORNEA; B, VESSELS EXTENDING TOWARDS CENTRAL SLOUGH; C, CENTRAL MASS OF GRANULATIONS FORMING AS A RING AROUND CENTRAL SLOUGH; D, CENTRAL MASS OF GRANULATIONS PROJECTING AS A BLEB AFTER PUSHING OFF THE SLOUGH. THE FEEDING VESSELS ARE DISAPPEARING. E, TWO DESCOMETOCOELES FORMED BY SEPARATION OF BITS OF THE CENTRAL SLOUGH BEFORE THE VESSELS HAVE REACHED IT.

The charac-
ter may be
follows:
1. Application
symptoms
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2. The pupil
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3. Perforation
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A STUDY OF LEWISITE LESIONS OF THE EYES OF RABBITS

IDA MANN, A. PIRIE, AND B. D. PULLINGER

London and Oxford, England

The effects of mustard gas when applied to the rabbit's eye by various methods have been set out in a previous publication.¹ We consider it of interest to describe a parallel series of experiments using Lewisite (β -chlorovinyl-dichlorarsine), since the actions of the two chemical-warfare agents appear to differ in all important points. This is only to be expected, for mustard and Lewisite react largely with different groups in the protein molecule, and the difference in the pathologic changes in the eye lesions probably reflects this fundamental difference.

The characteristics of mustard-gas lesions may be briefly summarized as follows:

1. Application is not painful, and symptoms do not appear for some hours.
2. The pupillary reaction is not affected.
3. Perforation and loss of an eye are caused only by relatively large doses (0.005 c.c.), and even then are long delayed. Perforation never occurs as a primary lesion before the stage of vascularization.
4. Vascularization never occurs unless the limbus is damaged by the mustard (that is, purely corneal lesions do not vascularize).
5. Vascular lesions do not all perforate; they tend to be chronic, to relapse, and to show intracorneal

hemorrhages from newly formed vessels, which latter are of peculiar and characteristic form.

6. Cholesterin and other lipid scars follow some vascular lesions, and subsequently these tend to break down² (delayed mustard-gas keratitis).
7. Edema of conjunctiva and cornea is present, but not excessive.
8. Iris and ciliary body are relatively little involved. There is no late effect on pigment.
9. Characteristic vessels form in cornea and conjunctiva.

In the case of Lewisite we shall show that:

1. The action is immediate and painful.
2. There is an immediate strong miotic action.
3. Perforation and loss of an eye are caused with relatively small doses (0.001 c.c.); perforation may occur within a few days without vascularization, or later after the entry of blood vessels.
4. Vascularization is independent of the site of the primary lesion; it occurs when a sufficient dose of the Lewisite reaches either the cornea or the limbus.
5. All lesions run a definite course to recovery or destruction; not all vascular lesions perforate; there are no relapses and no recurrent hemorrhages.

EXPERIMENTAL PROCEDURE

- Animals used.* A variety of rabbits was used, including black, with dark-brown eyes; crossed Dutch, with blue eyes; some with gray, and some with heterochromic eyes. The animals with blue eyes were used to study the effect on iris vessels, since dilatation of vessels and small hemorrhages can be most easily seen in them; those with brown eyes were used to study depigmentation of the mesodermal pigment of the iris; and those with either blue or brown eyes could be used in the observation of proliferating limbal conjunctival pigment rings in most individuals. Albino eyes are not suitable, as they are very difficult to observe accurately during life; moreover, many of the reactions seen in pigmented rabbits do not occur in the albino. Twenty-seven experiments were performed.

Method of application of Lewisite.

Three different methods of application were used.

1. The rabbits were anesthetized, and the lids held open. The center of the cornea was exposed to Lewisite vapor obtained from cotton-wool pledgets soaked with Lewisite inserted into the open ends of glass tubes of varying sizes. The tubes were then held over, but not in contact with, the part of the eye required, for varying lengths of time. The dosage was impossible to standardize, but a series of "very mild" and "mild" lesions was produced.

2. The rabbits were anesthetized, and small glass applicators, similar to those described in our mustard experiments, were used. They delivered between 0.1 mg. and 0.2 mg. of liquid Lewisite, as determined by arsenic estimations. The lids were held open, and applications made to the cornea or the limbus, as re-

6. Cholesterin and other lipid scars do not occur, and there is no late breakdown due to them. The end result of a nonperforating severe lesion is dense fibrous scarring with pigment proliferation on the corneal and conjunctival epithelium.

7. Edema of the lids and conjunctiva is immediate and severe; edema of the cornea is extreme with all but the smallest doses.

8. Involvement of the iris and ciliary body is early and severe, followed by gradual depigmentation and shrinkage of the iris stroma.

9. The corneal vessels do not show the characteristic varicosities of mustard vessels. They are straight and evenly and radially arranged. No characteristic vessels appear in the conjunctiva.

These conclusions show that Lewisite has a much more destructive and extensive effect than mustard gas. It is much more difficult, therefore, to produce minimal lesions and, indeed, this can be done only by means of short exposures to vapor, whereas in the case of mustard gas, minimal lesions can be obtained with liquid.

The clinical report which follows is based on observations of lesions of varying severity obtained by treating 27 rabbit eyes with varying amounts of Lewisite vapor or liquid. The lesions are classified according to severity. "Very mild" and "mild" lesions are those which (after short exposures to vapor) recovered without passing through a stage of corneal vascularization. "Severe" lesions (produced by longer exposure to vapor) recovered with slight permanent scarring after partial vascularization. In "very severe" lesions, the eye was lost by shrinking and corneal scarring with or without perforation.

quired. "Severe" lesions were produced in this way.

3. Unanesthetized rabbits were used with the same applicators as in method 2, but the rabbits were allowed to blink so that the liquid was immediately spread out and involved cornea, conjunctiva, and lids. This type of lesion simulates that likely to occur in persons exposed to Lewisite spray.

EXPERIMENTAL RESULTS

GROUP I.

Very mild lesions. Ten eyes were examined. All the injuries in this group were produced by vapor, and the rabbits were anesthetized, so that it is not known whether exposure to Lewisite vapor is painful in rabbits.*

At the time of application the eyes were observed for 15 minutes, and at frequent intervals after that. During the first 15 minutes, there was no conspicuous change in the corneal epithelium, except that it showed slight pitting due to exposure, and occasionally appeared faintly grayish. In 15 minutes, isolated hydropic cells began to appear in the epithelium. These increased to a definite bedewing in $1\frac{1}{2}$ hours. The pupil did not contract, but the iris vessels flushed in most eyes within 5 minutes; in one rabbit in $3\frac{1}{2}$ minutes. Lacrimation was variable, but usually appeared in from 6 to 10 minutes.

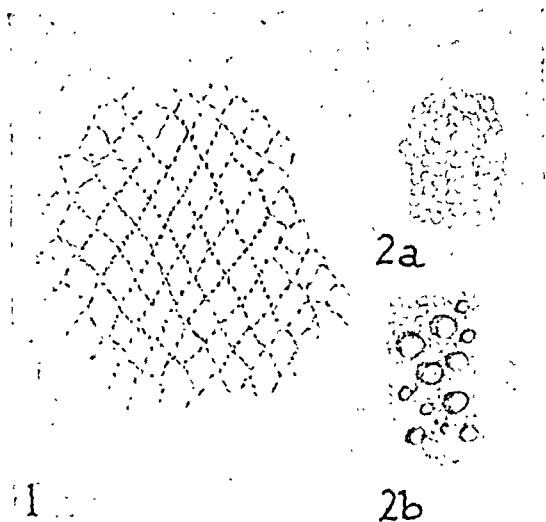
* Judging from the sensations of two human beings exposed to extremely small concentrations of Lewisite and of ethyl dichlorarsine, respectively, a stinging sensation is felt immediately, and it would be almost impossible to keep the eyes open for anything like the time needed to produce a serious corneal lesion. In respect of sensory irritation, Lewisite vapor differs conspicuously from mustard gas, and the risk to the eyes from vapor might, therefore, be small, in spite of its much more violent action. The main risk would be from the the entry of a single droplet, such as was used in the third set of experiments.

In $1\frac{1}{2}$ hours, or less, the exposed area revealed a fine punctate staining with fluorescein. This increased in density for approximately 7 hours and then became less. It had practically disappeared at the end of 24 hours and, in all eyes, cleared up completely within 36 hours.

Slight mucopurulent discharge appeared, derived especially from the third lid, which became somewhat edematous in $2\frac{1}{4}$ hours. This edema and discharge cleared up in all eyes within 36 hours.

Interesting changes occurred in the substantia propria and the endothelium in these very mild injuries. They were observed in detail with the slitlamp. Within an hour, the corneal corpuscles could be recognized in direct illumination much more easily and over a wider area than normal. They appeared to be swelling, but were not opaque (that is, not visible by retroillumination or sclerotic scatter). The endothelium, however, in about half the eyes showed a widespread and peculiar change, the cells swelling up and producing a series of faint linear ridges arranged in a diamond pattern, easily visible by retroillumination (fig. 1). It was possible to watch the development of this diamond pattern, which formed quite rapidly at the end of the first hour, taking about 10 minutes to become complete.

During the same time, irregularities of the epi- and endothelial surfaces were seen forming in the zones of specular reflection. These appearances were transitory, lasting from 2 to 3 hours to a day, not seen in every case, and gradually being replaced by a condition of uniform swelling of every endothelial cell. This swelling was much greater than ordinary "endothelial bedewing" and was easily visible all over the cornea (fig. 2). When it subsided, large Hassle-Henle bodies sometimes appeared. It began to subside



Figs. 1 and 2 (Mann *et al.*). Fig. 1, Diamond pattern on the endothelium seen by retroillumination. Fig. 2a, Edema of endothelial cells—very gross bedewing. 2b, Hassle-Henle bodies formed after healing.

in 3 days and had gone in 5 days, or less. The swelling of the corneal corpuscles sometimes continued. They became increasingly easily visible, being seen not only by direct illumination, but soon (24 hours) by retroillumination as well, and in two days presenting a characteristic appearance. They were then very swollen, fluffy, and opaque, and could be seen by light scattered within the cornea (corneal or sclerotic scatter), as well as by retroillumination. A profound change had occurred in them which completely altered their physical properties, including their index of refraction. They will be referred to as "opaque corneal corpuscles." They appeared through the whole thickness of the cornea (fig. 3).

At the same time, the surface layers of the substantia propria became split apart and edematous, but in these very mild lesions the stratification did not extend deeper than the superficial quarter and might not even occur. It reached its maximum in 3 to 4 days and then subsided rapidly, within the next 24 hours, disappearing by the 5th day.

The changes in the iris might not progress beyond the initial hyperemia, which subsided in 24 hours. In some eyes, however, although no aqueous flare was observed, a small amount of deposit, possibly fibrinous, was seen on the endothelium on the fourth day. In no case was

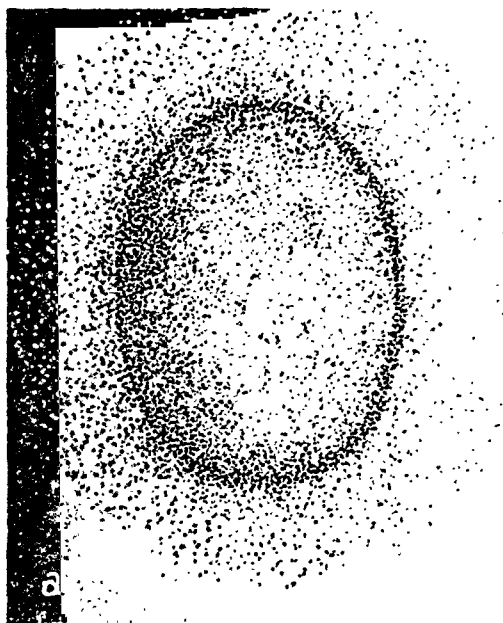


Fig. 3a (Mann *et al.*). Opaque corneal corpuscles seen by sclerotic scatter and in the narrow beam of the slitlamp. In a central Lewisite vapor lesion. Those in the center of the lesion are completely destroyed, those at the periphery are all opaque. Farther out they are more scattered.

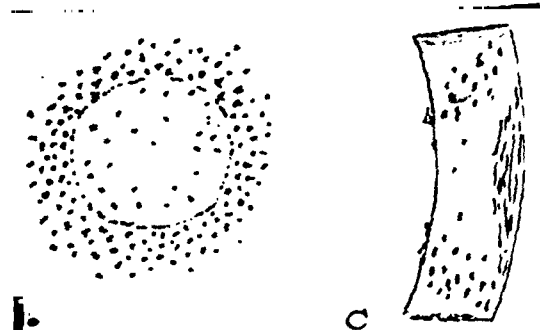


Fig. 3b (Mann *et al.*). In a minimal lesion, showing as in fig. 3a, destruction of the central cells and opacity of those around the periphery. Fig. 3c, The lesion in b in the narrow beam. Note funnel-shaped arrangement of opaque corpuscles, edema of surface layers of substantia propria and endothelial deposits.

any alteration in the color of the iris seen in either blue- or brown-eyed rabbits, nor was there any disturbance of uveal pigment or of the lens capsule.

The fate of the "opaque corneal corpuscles" requires histologic investigation for its complete elucidation, but with a slitlamp certain changes were observed. It was possible by directing the vapor towards the center of the cornea to produce a localized circular lesion. The circumference of the circle on the first day showed large numbers of these opaque cells (fig. 3). Within this ring, there was a narrow clear zone. In the center of the circle, the superficial layers of the substantia propria were edematous, and the deeper layers contained remnants and debris of cells, with perhaps a few opaque cells in the deepest layers only. The opaque condition of the cells appeared to be an intermediate one between normality and complete destruction. This appearance continued for 3 or 4 days and then, in the zone of opaque cells, very fine short processes were made out in connection with some of the cells. These fine processes increased in size and in number, and the cell bodies became less visible.

From the 5th to the 8th day, the ring was slowly transformed from a ring of opaque cells to a circular zone of long silky fibrils (fig. 4). These were seen progressing towards the center of the circle, which then looked clear and almost normal, though it contained some opaque cells. By about the 12th day, the whole lesion was transformed into a patch of fine silkiness. This appearance slowly faded, and no trace of the lesion was finally left. In one case the cornea was completely normal in 9 days; in others, faint silkiness could still be detected in a month. In most, no trace of any abnormality could be found in 6 weeks.

This type of lesion is, therefore, characterized by very transient conjunc-

tival and iris irritations and by damage to corneal corpuscles. Some kind of repair is effected, possibly originating in the partially damaged corneal corpuscles.

GROUP II.

Mild vapor lesion. Two eyes were examined in this group. They were not very different from the lesions in Group I, except that they were more severe and longer in clearing up. Their characteristic

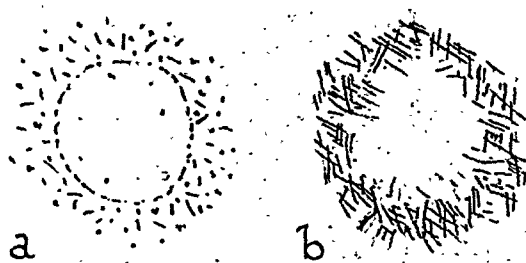


Fig. 4 (Mann *et al.*). Changes in the opaque corneal corpuscles: a, At the 5th day they are seen to be elongating. b, At the 8th day they are transformed into a ring of silky fibrils.

was a short period of intense edema of the cornea, with increased activity of the limbal blood vessels, which appeared about to enter the cornea and then retrogressed. The contraction of the pupil, which will be seen to be characteristic of the next group, occurred in the worse of these two mild lesions.

The course of events in this eye is typical. A grayish patch was seen almost immediately on the epithelium. The pupil contracted, and the iris began to flush within half an hour. The typical diamond pattern appeared on the endothelium in an hour, when the smallest iris capillaries were also dilating. In 2 hours and 20 minutes, the eyelids looked pink, and the third lid showed slight edema. The edema of the substantia propria was beginning. Slight discharge appeared later, and at 5 hours and 40 minutes, the epithelium over the point of maximum exposure had sloughed off, and the edema of the substantia

propria had considerably increased. At the end of 24 hours, the cornea looked "steamy" and was too hazy for any details of iris or anterior chamber to be seen. In 2 days the cornea was intensely swollen, an aqueous flare could be seen, and the eye looked worse, though there was no more discharge. The cornea was very much increased in thickness, was waterlogged, and appeared to be split into two layers: a superficial layer—very edematous and pale blue in color, with wide separation of the fibrils—and a deeper, more dense and homogenous layer, of a more yellow color (fig. 5). The appearance was peculiar and characteristic, the eye seeming to bulge, the contour of the cornea being almost conical, and the eyes looking rather like moonstones and definitely bluish in color. The term "moonstone eye" was coined to describe the condition. This continued for 5 days, when the limbal blood vessels became active and a few superficial loops crossed the limbus on to the cornea. The iritis had, however, subsided completely, leaving two small posterior synechiae and a fibrinous deposit on the endothelium.

In 6 days, the vessels disappeared, the edema started to subside, and the eye to improve rapidly, so that in 15 days it appeared perfectly normal to macroscopic examination. The slitlamp, however, showed a fine silkiness which persisted in its densest part for $5\frac{1}{2}$ months and may be permanent. It is, however, too slight to interfere with vision, and the eye may be considered normal.

This rabbit showed in a minor degree the edema which is so characteristic of the more severe lesions.

GROUP III.

Severe vapor lesion. Three eyes were examined in this group which showed partial recovery with fair function, after vascularization. At the time of application,

the corneal epithelium became grayish, and the pupil contracted strongly. The early changes were similar to those in Group II; namely, changes in the epithelium and endothelium, and flushing of the iris. The diamond pattern appeared on the endothelium in half an hour, and edema of the superficial layers of the substantia propria was also beginning at that time. An aqueous flare was noted at 2 hours. All the changes began slightly earlier and were more evident than in Group II. The substantia propria began to split into layers at 4 hours, and the edema was advanced in 24 hours, so that the cornea had a distinct opalescent appearance and was almost at the moonstone stage.

At 24 hours, there was a staining area in the center of the cornea, corresponding to the region of epithelial destruction. The remaining epithelium and endothelium were heavily bedewed. The injected iris showed through the edematous cornea with a distinct universal red glow. There was an aqueous flare, and free cells were seen in the aqueous. A curious pattern of concentric circles of fine pigmented dots could be seen on the anterior surface of the lens capsule, probably a deposit from the aqueous of blood and pigment-containing cells. There was little or no discharge, although the conjunctiva was hyperemic.

In 2 days the corneas presented the typical moonstone appearance. They were swollen and bulging, bedewed and edematous, and no details of cells could be seen. The staining had practically gone. The iris still appeared bright red.

The moonstone appearance increased for 5 days and did not then subside, as it did in Group II. Instead, on the 5th or 6th day, the engorged limbal blood vessels began to invade the cornea around almost the whole circumference simultaneously. These vessels were both super-

around towards the center. As they advanced, they became very regularly arranged in a radial row of thin parallel channels of even caliber, lying in the superficial layers of the substantia

ficial and deep. The deeper ones were larger and sent out more branches than the superficial ones; but all of them were straighter, of more even caliber, and more regular arrangement than those seen in a

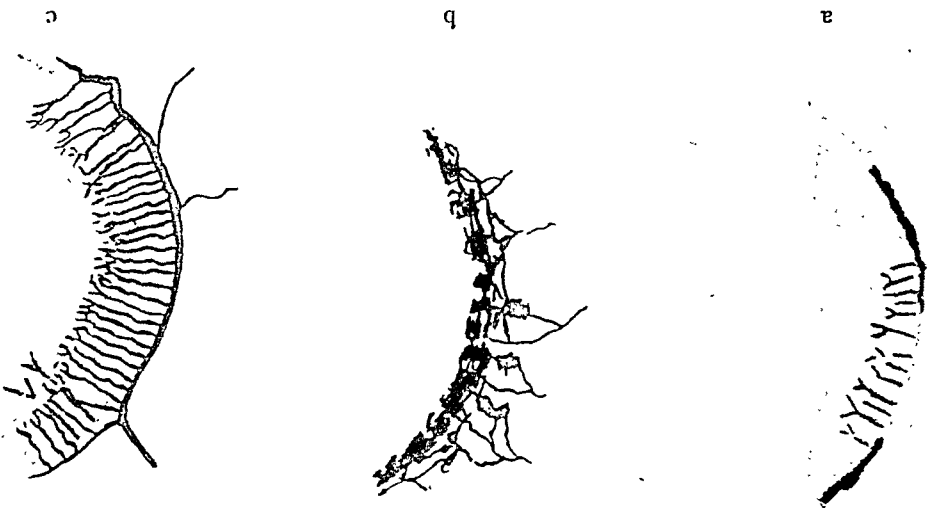


Fig. 6



Fig. 12

Fig. 6 (Mann *et al.*). Vascularization: a, deep vessels; b, superficial vessels preceded by capillary hemorrhages; c, radially arranged superficial vessels. A deep vessel is seen near the top.
Fig. 12 (Mann *et al.*). Two scarred and shrunken eyes showing bizarre pigment proliferation.

mustard-gas vascularization. They were preceded by small intracorneal hemorrhages, which soon cleared up and did not tend to recur over long periods, as did those typical of mustard gas (fig. 6). The vessels advanced for 14 to 18 days, growing steadily in from the limbus all

propria. At their extending tips, they branched and formed a very rich capillary network, with a few detached ends and small hemorrhages only. They resembled the new vessels of granulation tissue much more than do those of mustard-gas vascularization, which do not end in a

capillary arborization, but as straight tips. After 18 days, the edema began to clear rapidly, the vessels ceased to advance, became thinner, and the fine capillaries disappeared rapidly. The larger radial trunks also disappeared, except for a few of the largest ones.

In 3 weeks the edema of the substantia propria disappeared, the cornea returned to its normal thickness, although it still showed disturbance of endothelium (beaten-silver reflex), and there might be slight epithelial bedeviling. The vessels were all narrow and empty, or showed slow and interrupted circulation only. The larger trunks alone were visible. As the edema of the cornea subsided, a fine silky change was seen all over it, similar to that seen in the other groups, although in Group III the excessive edema obscured the preceding stage of opaque corneal corpuscles. This fine silkiness slowly disappeared in about 6 months.

As the cornea cleared (after the 18th day), the iris again became visible. It was then seen that profound changes had occurred in it. Brown-eyed rabbits showed these changes best. At 18 days, or sooner, it was noticed that the iris, to macroscopic observation, no longer looked dark brown, as it was originally, or bright or dull red, as it was at the height of the reaction, but had become light blue. This remarkable change might involve the whole iris, but was most conspicuous in the circum pupillary zone over half the width of the iris or more (fig. 7). The blue patches might be circinate in outline, or confluent; in some eyes, only a narrow peripheral ring of brown was left. If examined in more detail, the pupil was seen to be somewhat dilated, was irregular in outline, and possibly showed a few posterior synechiae. Here and there, usually above and below, there was considerable ectropion of the uvea, as though the dilated appearance of the pupil were

GROUP IV.

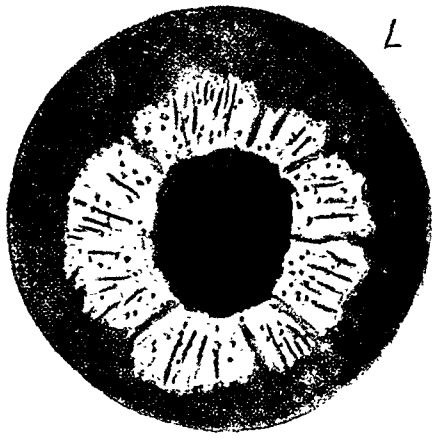
Very severe lesions. These lesions ended in loss of the eye. Twelve eyes

due to contraction of the stroma. In some cases this was so excessive at one or two spots that the tips of the ciliary processes were pulled right around, so that they appeared at the edge of the pupil. The sphincter was not destroyed, since these distorted pupils showed a reaction to light. The stroma of the iris had undergone a peculiar change. In the brown zone at the periphery, the chromatophores appeared normal, bright brown, with long interlacing processes, and spread out in an even sheet. As the light-blue areas were approached, the chromatophores became darker in color, lost their processes, and resembled very dark-brown spherical and amorphous deposits, rather than cells. This withdrawal of processes was confirmed microscopically. The cells were thickly aggregated at the edges of the blue areas and were present all over those as isolated dark spots dotted over the unpigmented stroma. This stroma, exposed by the retraction of the chromatophores, appeared at the 18th day somewhat edematous and translucent. The vessel walls were easily seen and appeared normal. The stroma finally looked fluffy and atrophic and, at times, as if the surface layer had been torn off, leaving odd tags and fringes floating loosely attached. This change and the ectropion of the uvea appears to be permanent, having been observed for 8 months without further alteration. No change was observed in the ectodermal uveal pigment, other than ectropion. It was not degenerated.

These eyes appeared to have excellent function in spite of the residue of the severe iritis. The fundi were examined with an ophthalmoscope and appeared normal.



FIG. 5 (MANN ET AL.) THE WATER-LOGGED CORNEA OF A "MOONSTONE EYE" SEEN IN THE NARROW BEAM OF THE SLITLAMP; THE SURFACE LAYER IS BLuish, THE DEEPER PART YELLOWISH.
FIG. 7 (MANN ET AL.) A BROWN EYE WITH CIRCINATE PATCHES OF DEPIGMENTATION AROUND THE PUPIL, AND SOME ECTROPION OF THE UVEAL MARGIN OF THE PUPIL



from rabbit to rabbit. In 5½ minutes there was a faint surface haze over the whole cornea. In 10 minutes, the conjunctival vessels were flushed. In 15 minutes, a severe chemosis of the ocular and



Fig. 8 (Mann *et al.*). Severe chemosis of ocular or palpebral conjunctiva 30 minutes after a droplet of liquid Lewisite entered the eye.

palpebral conjunctiva was beginning, even in eyes in which the cornea alone had been treated. In those in which the conjunctiva was injured, it appeared sooner, but was otherwise similar. The areas involved stained only very faintly with fluorescein at this stage (fig. 8).

In half an hour the corneal epithelium had become so edematous that it was impossible to see any details of the iris. In 1½ hours, the epithelium was beginning to loosen and slough off, giving an almost universal stain with fluorescein. In 4 hours, or less, there was a watery discharge containing cells, and the chemosis had reached surprising proportions. The entire conjunctiva, ocular and palpebral, was enormously swollen, so that the lids were held right away from the eye, sometimes bulging more than half an inch. The cornea was overlapped by folds of gelatinous injected conjunctiva, the appearance of the eye being striking and peculiar. The swollen conjunctiva was covered with fine vessels, and small petechiae were seen to develop. The lymphatics were widely open and were easily observable

were examined. The initial sequence of events was similar, but more rapid and more severe than that seen in Group III. Some of the lesions in this group of 12 eyes were produced by a single droplet of liquid Lewisite; others were caused by exposure to vapor for varying times, up to 20 minutes. In some eyes the cornea alone was injured, in others the limbus, and in others again the cornea, limbus, lids, and conjunctiva were affected. Thus, some of the original injuries were more severe than others, although all the eyes were finally lost. The exact method of application did not appear to be important, except in those cases where the lids and conjunctiva were extensively injured, when the eye was lost in about half the usual time, and many of the stages of destruction were telescoped.

As a point of interest, it may be mentioned here that liquid Lewisite applied to the ocular conjunctiva increases the transparency of the sclera so that the uveal pigment shows through in 2 minutes as a black spot. This disappears within a day.

The eyes can be divided roughly into (a) those lost after initial vascularization and (b) those which perforated before vessels had entered the cornea. (a) The course of events in an eye lost after initial vascularization was as follows: The site of application of the liquid or vapor became immediately opaque. When liquid was used the droplet showed no tendency to slide. It appeared to soak into the cornea almost instantaneously, the opaque area increasing in size by spreading concentrically for about two minutes. The Lewisite then reached the aqueous, where it diffused rapidly, the whole iris flushing, and the pupil contracting very quickly and strongly, so that in 2½ minutes, it was pinpoint in size. There was some secretion of clear tears but this was variable

as clear, distended, optically-empty tubes in the narrow beam of the slitlamp (fig. 9). The corneal epithelium had nearly all sloughed off. There was edema of the substantia propria in its superficial fourth. Descemet's membrane looked corrugated, and the pupil was still contracted. In seven hours the petechiae had increased in number and size. The whole cornea stained. The edema involved nearly its whole thickness. No details of cells or of the anterior chamber were seen.

In 24 hours a remarkable improvement in the chemosis had occurred, but the eye was much worse. The lids were again in apposition to the globe. There was very little discharge. Large conjunctival hemorrhages had appeared. The whole cornea stained, and the stain reached the aqueous in 5 minutes.

The anterior chamber was now visible. It was full of strands of gelatinous exudate, forming large solid masses in the lower part. The circulation of the aqueous appeared to have ceased, as the green color of the fluorescein was unchanged in 6 hours and was only slightly diminished in 24 hours after application. In 2 days there was practically no discharge, but the cornea still stained and was more opaque. The surface of the iris looked an almost uniform blood red. At 3 days, there was an attempt at regeneration of the conjunctival epithelium from the limbus and, if this were pigmented, a pigment slide was seen. The staining was not quite complete.

At 4 days, there was no discharge, but the eye was slightly worse. At 5 days, there might be a somewhat moonstone effect as the corneal edema began to increase, but this stage of intense swelling was less the more severely the eye was damaged. Between the 6th and the 8th day, vessels began to invade the cornea, usually first above and below, but soon equally all

around. The center of the cornea still stained and became excessively swollen, unless the eye was very severely damaged. The vessels continued to grow in from the 6th to the 24th day, when they had almost reached the center. In a few eyes, this happened at the 20th day, or might be delayed for 34 days. The arrangement of these vessels was striking. They were long, straight, and radially arranged at right angles to the corneoscleral junction. They were excessively numerous and appeared to naked-eye examination almost like a sheet of blood. As they approached the center, the periphery of the cornea cleared somewhat, and the growing tips only showed as a bright-red ring which contracted as it advanced, appearing to push the edema ahead of it, so that the center of the cornea looked like a conical blue projection in the center of a red circle. This central cone became smaller, and the contracting ring of capillaries was raised into a ridge of advancing granulation tissue, which finally reached the center and projected as a small knot or bleb. As this happened, the central parts showed a gradually diminishing staining area. Finally, the center of the cornea was cast off as a small slough. In some cases, this coincided with the arrival of the ring of granulations at the center, and there was no true perforation. Sometimes, on the other hand, the central slough separated before the vessels had reached it and a descemetocoele, which rapidly perforated, resulted (fig. 10). In either case (granulation or perforation) the eye then rapidly shrank and the vessels narrowed and became less in number, but did not disappear. Perforation or separation of the central slough (fig. 11) might occur at any time from the 19th to the 34th day (earlier in the most severe lesions, as will be seen later). The eye then ceased to stain, shrank, and quieted to a condition of phthisis bulbi. A slight mucocoele

purulent discharge continued the whole time, varying from day to day, but not severe. In $1\frac{1}{2}$ to 2 months, the shrunk eye became pigmented in parts. The limbal pigment ring proliferated, and large, dense, almost black masses of pigment grew on to the cornea in sector-

Lewisite produced necrosis of the cornea before the blood vessels had extended into it. Both lesions were produced by a large droplet. In one case, the rabbit was anesthetized; in the other, it was not anesthetized and was allowed to close the eye at once, thus spreading the Lewisite

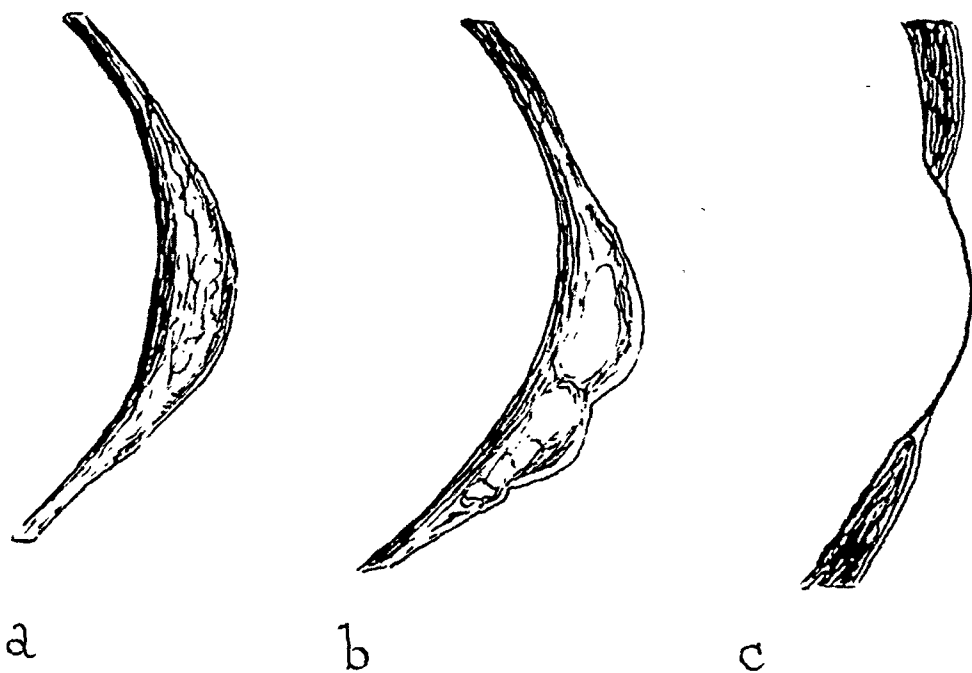


Fig. 11 (Mann *et al.*). Stages in the formation of a descemetocoele, seen with the narrow beam of the slitlamp: a, severe edema; b, formation of large fluid spaces; c, perforation only closed by Descemet's membrane.

shaped fringes (fig. 12). The scarred eye became less vascular, and it was often possible to make out, here and there, traces of depigmented iris. There was usually an almost complete anterior synechia, and the pupil was filled with cyclitic membrane. Uveal pigment might be seen on the back of the remains of the cornea. The eye was useless.

(b) Severe lesions which perforate before blood vessels enter the cornea: In 2 eyes of the 12 in the series of very severe lesions the destructive action of the

all over the conjunctival sac. The sequence of events in this eye began with instantaneous intense spasm of the lids, followed by lacrimation in 20 seconds (at first clear tears; in 1 minute and 20 seconds, milky Harderian secretion). In 6 minutes, the third lid was becoming edematous and in 10 minutes, the lids themselves started to swell. The eye was kept closed with occasional blinks. In 20 minutes, the edema was so great that the lids were lifted off the globe and the eye could hardly be kept closed. In 3 hours,

it was not possible to see the cornea, and there were conjunctival petechiae. Laceration continued.

In 24 hours the edema was beginning to subside, and the eye was discharging mucopus. There was a violent iritis, and the cornea was edematous all over in the superficial third. The whole cornea stained. On the 3rd day, there was much discharge, and the lids were stuck together with discharge. There was severe iritis. The cornea was not very swollen.

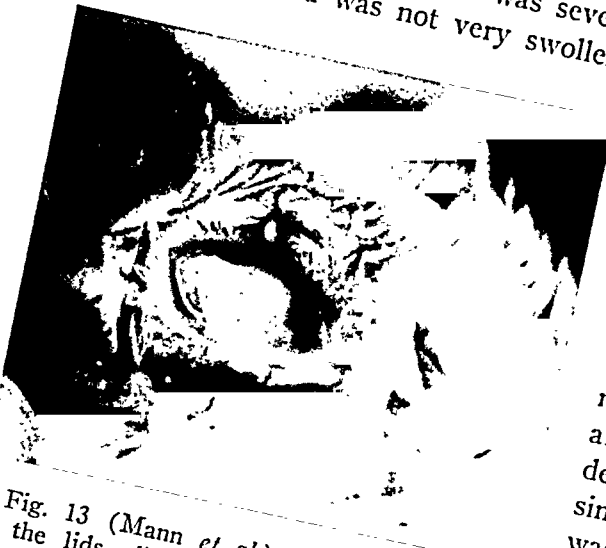


Fig. 13 (Mann *et al.*). Brawny induration of the lids, discharge and sloughing of the cornea in a very severe Lewisite lesion on the 12th day.

The stain of the day before was still present in the anterior chamber. On the 8th day, there was hypopyon, and the lids were brawny and contracting down on the globe, so that the eye could not be fully opened. No vessels had entered the cornea, which was more opaque. In 10 days, the cornea was still avascular, very opaque, and covered with pus (fig. 13). On the 14th day, the center of the cornea appeared to liquefy and melt away, leaving a descemetocoele which remained intact till the 26th day, when it ruptured, leaving only the remains of an eye in a mass of pus. No attempt at repair or vasculari-

zation took place. The lids and conjunctiva continued to shrink, so that by the 36th day all that could be seen was a narrow discharging palpebral aperture between lids adherent to a disorganized globe.

The course of the lesion in the other eye in this category in an unanesthetized rabbit was similar, the descemetocoele appearing on the 12th day, when this rabbit was killed. Here again there was severe discharge.

These two lesions seem to show that widespread damage to the conjunctiva leads to persistent discharge, failure to vascularize, and to shrinking of the conjunctiva. In the rest of the "very severe" series, the conjunctiva was damaged, but never over so wide an area as in these two.

Many of the rabbits were watched for nearly a year and in no case, was secondary lipoid degeneration and cholesterol deposition observed, so that no condition similar to delayed mustard-gas keratitis was seen, nor seemed likely to occur. The eyes either recovered completely, showed stable scars, or were completely destroyed. The main points of interest were: (i) Peculiar effect on corneal endothelium and corneal corpuscles. (ii) Miosis. (iii) Intense, but transient, edema of lids and conjunctiva. (iv) Intense edema of the cornea, reaching a maximum after the lid swelling had subsided. (v) Characteristic type of vascularization. (vi) Involvement of iris and ciliary body with mesodermal depigmentation and shrinking, and ectodermal pigment displacement. (vii) Effects appear specific for total dose entering eye rather than for anatomical site of lesion.

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TABLE 1
LEWISITE LESIONS OF VARYING SEVERITY IN 27 RABBITS' EYES

Very Mild	Mild	Severe	Very Severe
No immediate change. Iris flushed in 5 min. ↓ Punctate staining in 1½ hrs. and increased visibility of corneal corpuscles and diamond pattern on endothelium ↓ Opaque corneal corpuscles in 2 days and slight edema ↓ Silkiness 5-8 days. Disappears in a month or less	Pupil contracted in 2 min. ↓ Diamond pattern in 1 hr. Slight edema of lids, 2½ hr. ↓ Cornea staining 1 day. Iritis ↓ "Moonstone eye," 2 days ↓ Subsidence of edema, 6 days ↓ Recovery with fine silkiness, 16 days	Pupil contracted, 2 min. ↓ Diamond pattern in ¼ hr. and edema of substantia propria ↓ Early "moonstone eye." Severe iritis. Deposit on lens, 1 day ↓ Invasion of cornea by vessels, 6 days ↓ Subsidence of edema and retrogression of vessels, 18 days ↓ Recovery with remains of vessels and depigmentation of iris, 3-4 weeks	Contraction of pupil, 2 min. ↓ Severe chemosis and complete corneal haze, 15 min. ↓ Discharge and extreme chemosis, 4 hr. ↓ Chemosis better. Acute iritis 1 day ↓ Invasion by vessels, 6 days ↓ Vessels reach central slough, 20-30 days ↓ Separation of central slough or perforation, 20-34 days ↓ Phthisis bulbi and pigmentation of cornea, 2 months
			Copious discharge, 5 days ↓ Hypopyon, 8 days ↓ Perforation, 14 days ↓ Complete symblepharon and phthisis bulbi, 30 days

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MACULAR EDEMA*

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Edema of the macula may be an isolated condition or part of a general fundus change.

It is universally agreed that the macula varies in size from 1 to 3 mm. in diameter. In or near the center of it is the region of greatest differentiation and specialization. The absence of vessels in the macular region, the foveal depression, and the relatively thick surrounding retina must be considered as determining factors in the appearance of the lesions. Ophthalmoscopically, the macular region is often dark red, and almost invariably the surface changes can be recognized in stereoscopic examination or photographs.

For years, the bright spot seen with the ophthalmoscope in front of the fovea has been called the foveal reflex. It can be proved that the spot is very often absent in a healthy eye with normal, central visual acuity, and also that sometimes the reflex comes from different portions of the vitreous over the same macula in the photographs making a stereoscopic pair. Furthermore, this and the grosser macular reflexes are in front of the retina, vary greatly in visibility, are easily dispelled by a change in the angle of light reflection, and are on the vitreous. When the more delicate lesions, such as foveo-macular disease, are studied, this understanding is essential to interpret correctly the faint changes and the exact placement of each. The macula, although commonly to the temporal side of the disc and slightly below the horizontal level, may be several millimeters above or below its usual location. This is one cause

of head tilting and must be remembered in off-center macular edema. The macula may also be displaced laterally.

Some observers report that they have seen a hole at the macula develop after Berlin's edema. I have not been so fortunate, for, certainly in the usual case of the Berlin type, the edema is transitory and complete functional restoration the rule.

On several occasions I have photographed a circulatory macular destruction from the primary stage of a gray, localized edema, and slight reduction in central vision, through the various phases of infiltration and retinal absorption, until a clear, punched-out, red-based, permanent hole was formed. This type of hole is often smaller than the common, traumatic one, and, eventually, in a high percentage of cases, both eyes become involved.

The hole which results from detachment of the retina or intraocular inflammations may be sharply delimited, or the margins may be soft with an elevated surrounding ring. They may be shallow, suggesting a less complete destruction of the retina; a complete loss, which looks like a red opening in the gray retina; or the margins may form a ridge.

The casual observer may confuse a round mass of exudate in the macular region with either localized edema or a hole. Circumscribed hemorrhages may be incorrectly diagnosed as a hole. The absorption of the exudate, or the blood, will eventually prove the diagnosis. Occasionally, a perfectly round macular scar results from the partial destruction of the retina and choroid.

In sudden occlusion of the central vein,

* Presented at the 15th scientific meeting of the Association for Research in Ophthalmology, Inc., at San Francisco, July 2, 1946.

the retina is very edematous, and frequently an oval-zone embracing the macula is especially prominent. In a branch closure, the edema extends from the closed vein over the macula. The blanched, milky-white edema of an abrupt closure of the central retinal artery is pathognomonic, and the macular red spot varies in size and color.

Stellate edema is characterized either by a circle of exudate spots about the edematous macula, or, and more often, by lines radiating from the macula toward the disc. As the edema subsides, the exudate spots decrease in number and, finally, if the case is observed long enough, they entirely disappear. The edema may be the result of an increased NPN without any other kidney dysfunction, or it may be part of a general hypertension.

In inflammations of the choroid or retina, the edema is often diffuse, covers a large macular surface, is thick, smoke-gray or yellow-tinged, and with or without hemorrhages. As the disease progresses, the edematous region decreases in size and thickness. In the terminal stage, a circumscribed white, plaquelike scar results, with or without pigmentation, and with or without vessels extending to and over it. There are many variations in the amount and disposition of the blood, its manner of absorption, its recurrence, and the association with cystic degeneration. Senile macular degeneration is frequently first observed as a circumscribed cloud of edema.

Another type of macular edema is that found in so-called retinitis circinata, which is not a disease but only a phase of a constantly changing fundus pattern of localized degenerations where a crown of exudate spots, thick, delicate, or even lacelike, surrounds the degenerating macula.

In 1928, I demonstrated photographs of

what we then called preretinal edema. The term is just as appropriate now as then, for it accurately describes the location and appearance of the lesion.

When fluid collects over the macular retina, there is, in the early stages, a demarcating circle or oval of reflection on the pushed-forward vitreous, beneath which the fundus appears dark. The retinal vessels can be traced behind the reflex, and there is no "foveal reflex." As time passes, the reflecting circle enlarges with a corresponding increase in the darker area until, finally, the reflex disappears.

Gifford and Marquardt have called this angiospastic retinopathy but whether this, or central serous retinopathy, or any other term is used, the fundus edema is the same. The disease is said to be limited to young adults. I have seen it in middle and late life.

I have not seen macular drusen nor local holes develop after preretinal edema, which is usually unilateral, rapidly subsides, and leaves few, if any, pigmentary changes. The macular area may appear red, and probably that is the reason why it has been mistaken for a hole. The early vitreous reflex cannot be seen with an ordinary ophthalmoscope.

A Gullstrand or binocular ophthalmoscope or a Nordenson camera is essential, if the earliest signs of macular edema are to be recognized. Errors in diagnosis can be avoided by using red or green filters, reducing the illumination or using indirect illumination, as well as by shifting the light beam from side to side.

There is considerable risk in drawing conclusions regarding any particular therapy for this disease, which is often of short duration and, I believe, uninfluenced by any special treatment.

There are two other conditions which, at times, so closely resemble preretinal

edema that differentiation is impossible without stereoscopic studies or photographs. These are retinal edema and circumscribed retinal detachment.

Macular retinitis may be ushered in by true edema with a large vitreous reflex. This reflex may disappear, be absent some days or weeks, and then reappear, again to disappear as the exudate increases. In this edema, the fundus area is elevated, the retinal vessels are on the surface and can be traced only by stereoscopic examination. The dark-appearing base increases in diameter, as in preretinal edema, until it finally disappears, and the retina assumes its normal color or becomes scarred. The diagnosis of retinal edema depends upon the location of the retinal vessels on the surface of the convex dome of swelling.

Macular retinitis may, however, start with a very slight edema, not to be confused with either the preretinal or retinal edema with ring-shaped light reflexes. From a small, hazy, gray spot, the cloud increases and eventually terminates in a retinal scar. Another type forms a small circle with a pale center and close to it a spot of retinal depigmentation. In some cases, the edema extends from an adjacent, acute exudative retinitis over the macula.

There have been several articles on detachment of the retina at the macula. Idiopathic, flat detachment of the retina has been carefully presented in the thesis of Walsh and Sloan. In any case, where a detachment is suspected, it is necessary to exclude preretinal or retinal edema before reaching such a diagnosis. Here, again, stereoscopic photographs are of great value.

Detachment of the macular retina is very uncommon. Sometimes it is several disc diameters in size and so dark and so prominent that great care must be taken to differentiate it from a malignant

growth of the choroid. Under such circumstances, repeated examinations are obligatory, and no eye should be sacrificed until the diagnosis is firmly established.

In some cases, the subretinal fluid is translucent, so that the outline of the detachment is readily seen. In others, as, for example, in myopia of high degree, a true cyst may partially or completely cover the macula. Some cysts are very small, while others may be more than a disc diameter in size and may be mistaken for a detachment.

The confusion in diagnosis is further increased if the patient is first examined when the condition is subsiding, for in all three—preretinal edema, retinal edema, and macular detachment of the retina—fine white specks, yellow dots, and minute or large pigmentations may develop and persist. These end results depend upon the duration, as well as the severity, of the local reaction, and it is difficult to anticipate or foretell with any degree of accuracy the exact terminal appearance of any given case.

During the past few months, several excellent articles on macular diseases have been published, and I wish to talk about some of them.

Adler and Scarlet, in their interesting paper, presented cases of juvenile macular choroiditis. Such cases are not rare. They are found in both males and females, start without demonstrable cause, follow a prescribed course, last many months, and although the fundus changes seem to vary little from week to week, they are, when carefully observed or photographed, continuous. There is a round, gray edema of the macular region, with some blood and a dark area near the center of the lesion, which, in the beginning, can only be seen with a red light. As time passes, the margin of the circle becomes more defined and the center so much

darker that it is readily seen with the light from any ophthalmoscope. The bleeding ceases, and eventually a circumscribed, round, gray-pigmented scar results. After the outer gray ring is once formed, it rarely increases in diameter. The end result may be a few, pale-gray or dense-black spots, a black ring, or a black center with a white, connective-tissue band across it. The circumscribed area, the uneven surface, the protracted course, and the recurring flat, granular hemorrhages are dominant characteristics of this type. Usually unilateral and occurring in young adults, I have, however, seen it in both eyes in late life.

The critical analysis of central visual impairment reported by Cordes for the group of Navy ophthalmologists is not only comprehensive and well done, but also thought-producing, for it stimulates all ophthalmologists to be accurate in the recognition of small deviations from the normal and correct in their interpretations.

Some months ago, before the Cordes report, I talked with him and said that I had been seeing peculiar macular lesions in young adults in the Army, as well as some officers in the Navy who had been in the earliest South-Pacific campaign. It is unfortunate that photographic records were not kept for patients in the European theater.

In the Cordes report, it is noted that, in certain types of trauma, there is a partial destruction of the macular region. The outline of the reddish area is indefinite, as it fades into the surrounding, normal-appearing retina, and looks like an incomplete hole. On closer inspection, the lesion is found to be a puckered scar, the apex of which is white and elevated, suggesting an accentuated, so-called foveal reflex.

In other cases, the macula is red and slightly depressed, showing a genuine,

superficial, partial destruction of the retina.

The study of complicated fundus patterns frequently leads to the correct interpretation of local changes. In a case of traumatic macular retinochoroiditis with retinitis proliferans, delicate hemorrhages were seen in the proliferans, as well as a pink spot which looked like a small hole in the retina. This was easily proved to be an opening in the proliferating sheet through which the red fundus background was visible. It is not improbable that some reported cases of hole at the macula may come under this group.

As an example, the same suggestion of a macular hole was found in the left eye of a young soldier whose fundus I had photographed and found normal before he entered the Service. He had recently noted a marked reduction in vision. To the outer side of the macular region was an elevated, gray layer with an almost circular, pink center, which was the retina seen through the overlying vitreous edema. When the acute stage subsided and the gray edema of the vitreous had disappeared, there were several pigmented granules over what had been the pink spot.

Most of the Service-connected cases, as well as those in civilian life, have been unilateral. The etiology is unknown.

SUMMARY

The common causes of edema of the macular region have been demonstrated.

Special attention has been drawn to Berlin's edema, the various causes for holes at the macula, and the inflammatory reactions of retinochoroiditis and retinitis.

In hemorrhagic exudate or traumatic hole, it is very probable that there is always some edema at some time, and, for that reason, examples of each are included.

Preretinal and retinal edema have been explained as a pushing outward of the vitreous, producing the ring-shaped light reflex which is on it.

Some of the recent papers on macular edema have been referred to, and additional illustrations of juvenile macular degeneration, central serous retinopathy, local detachment of the retina, and foveo-macular diseases have been presented.

CONCLUSIONS

An edema of the macular region may

be the isolated expression of a local or general tissue reaction. The edema may be limited to and disappear from the macula, or it may be the precursor of an extensive retinochoroiditis or gross macular change. The healed macula may show pigmented specks, white dots, heaped-up pigment, atrophy, or thick scars which may be smooth and flat, or rough and nodular.

This essay was illustrated by a series of Kodachrome photographs.

344 State Street.

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DISCUSSION

DR. RALPH I. LLOYD (Brooklyn): Will you give an idea of the apparatus used in making the diagnosis of this group of fundus lesions?

DR. BEDELL (closing): The diagnosis of all fundus lesions is made by the use of

the ordinary ophthalmoscope with red, green, and yellow filters and the Norden-son camera. The finest diagnostic detail is seen with the Nordenson and confirmed by the study of stereoscopic Kodachrome photographs.

THE RELATION BETWEEN MATERNAL VITAMIN-A INTAKE, BLOOD LEVEL, AND OCULAR ABNORMALITIES IN THE OFFSPRING OF THE RAT*

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The experimental production of congenital eye lesions by means of maternal vitamin-A deficiency has been demonstrated in several animal species. The literature on this subject has been reviewed recently by Warkany.¹

In the rat, the eyes of offspring born by vitamin-A-deficient mothers may show abnormalities resembling in some respects the condition of retrolental fibroplasia as found in man. The following eye defects are some of those described by Warkany and Schraffenberger as appearing in the rat: absence of anterior chamber, iris, and ciliary body; failure of vitreous formation, with the development in its place of connective tissue; eversion of the retina, and retinal disorganization.^{2, 3} These workers observed considerable variation in the degree of abnormality occurring in different litters. In some instances, the defect consisted only in the development of a retrolenticular mass of connective tissue.

The object of the present investigation was to attempt to repeat Warkany and Schraffenberger's findings and at the same time to determine the degree of the deficiency in the mothers which will lead to ocular maldevelopment.

EXPERIMENTAL PROCEDURE

Albino rats of the Sprague-Dawley strain were used. The Warkany procedure was followed in the first three experi-

* From the Pathology Laboratories of the Massachusetts Eye and Ear Infirmary and the Harvard Medical School. Presented at the 15th scientific meeting of the Association for Research in Ophthalmology, Inc., in San Francisco, July 2, 1946.

ments by placing female weanlings on a basal vitamin-A-deficient preparatory diet (Warkany's diet U¹)† supplemented with vitamin D and with carotene sufficient to allow growth and sexual maturation, but insufficient to allow the accumulation of significant hepatic stores. To mate the rats during the working day, their diurnal rhythms were reversed; this was accomplished by keeping them in rooms with reversed periods of light and dark. During this preparatory period, the animals were housed in large cages provided with wire-mesh floors; about 10 rats were kept in each cage. When the females were 90 to 100 days old, they were transferred to individual cages and fed a purified diet deficient in vitamin A (Warkany's diet W²).‡ Following Warkany, each animal received an oral dose of 50 I.U. of vitamin D, 2.5 mg. of α -tocopherol, and 10 micrograms of 2-methyl naphthoquinone every 10 days. Crystalline carotene (Smaco) dissolved in Wesson oil, or vitamin A, was administered orally as indicated in the separate experiments. For the mating of these females, healthy male rats of the same strain were used. In most instances, the time of mating was determined within a few hours by the presence of a vaginal plug or sperm.

Blood samples used for vitamin-A determination were obtained from the tail

† Percentage composition of Warkany and Schraffenberger's preparatory diet: Ground whole wheat, 74; crude casein (Borden), 15; brewers' yeast (Mead Johnson), 10; sodium chloride, 1.

‡ Percentage composition of Warkany and Schraffenberger's purified diet: Sucrose, 68; vitamin-test casein, 18; vegetable oil, 10; salt mixture, 4.

vein at least 20 hours after the administration of any vitamin-A supplement. When a sample was taken just prior to killing the animal, it was obtained by cardiac puncture. Vitamin-A analyses were made on approximately 0.1 ml. blood serum, according to the micro-method developed by Lowry and Bessey.⁴

First experiment. The first experiment was designed simply to reproduce Warkany's experiments. Fifty-seven female rats 25 days old were placed on the preparatory diet. They received 25 micrograms of carotene on the 34th, 44th, and 54th days of age. Because the animals showed more rapid growth than Warkany's,* the carotene supplement was then discontinued. On the 89th day, animals showing marked signs of vitamin-A deficiency were placed on the purified diet supplemented with one or two doses of 25 micrograms of carotene. On the 93d day, the remaining animals were transferred to the purified diet, and mating was begun. At this stage, many of these animals showed severe signs of vitamin-A depletion. The fur was dirty and stained, there were deposits of reddish material (porphyrin?) about the eyes, and the eyes showed the xerophthalmia characteristic of vitamin-A deficiency. Some animals exhibited respiratory difficulty. Nine rats died at 91 to 110 days of age, before being mated; at autopsy several were found to have kidney disorders involving infection, enlargement, and/or stone formation. To prevent more deaths, a maintenance dose of vitamin A (20 I.U. orally about every 10 days) was given to the

remaining rats during the period of mating and gestation.

Thirty animals were mated shortly after the diet change, and of these, 20 became pregnant. Five of the pregnant animals died within three weeks after mating. At the time of death, two of these had completely resorbed their fetuses; three had fetuses 18 to 19 days old which could be used for histologic examination. Six pregnant animals were killed 14 to 24 days after mating; five had fetuses in various states of resorption; one, however, had eight live 21-day old fetuses which could be used for histologic study. The other nine pregnant rats resorbed their litters. Thus, from 57 animals, fetuses in an advanced state of development were obtained from but four mothers.

Terminal vitamin-A analyses were made on two of the four animals which carried their young nearly to term. In both instances, the serum vitamin A was less than 5 I.U. per 100 ml. (the normal blood serum vitamin A for mature female rats of this strain is about 75 I.U. per 100 ml.) Further evidence that this is a vitamin-A deficiency is seen in the weight response of the animals to small doses of vitamin A (fig. 1).

The eyes of the young in all four litters exhibited ocular abnormalities essentially similar to those described by Warkany. Complete serial sections of the two eyes of one fetus from each litter were made, in addition to nonserial sections on two or three other members of each litter. In every instance, there was a retrolental mass of connective tissue; in the eyes from three litters it extended from the lens to the region of the nerve head. In all except one animal, there was marked retinal folding. In several eyes, there was slight retinal eversion near the nerve head. In one specimen (18-day), the fetal fissure had failed to close at any point. Large hemorrhages in both the primary

* This apparent discrepancy in growth rates was clarified by correspondence with Dr. Warkany. The original value cited in his first paper was a numerical error, since 4 micrograms instead of 25 micrograms of carotene were given every 10 days.

optic vesicle and the vitreous space were found in the eyes from two of the litters. Sections made from one of the abnormal eyes are shown in plate I. These abnormalities appear to be somewhat less severe than those studied by Warkany. For

spring. The animals used were a group of the original lot employed in the first experiment—those which were still unmated after several weeks on the purified diet and those which had resorbed their first litters. The animals were separated into

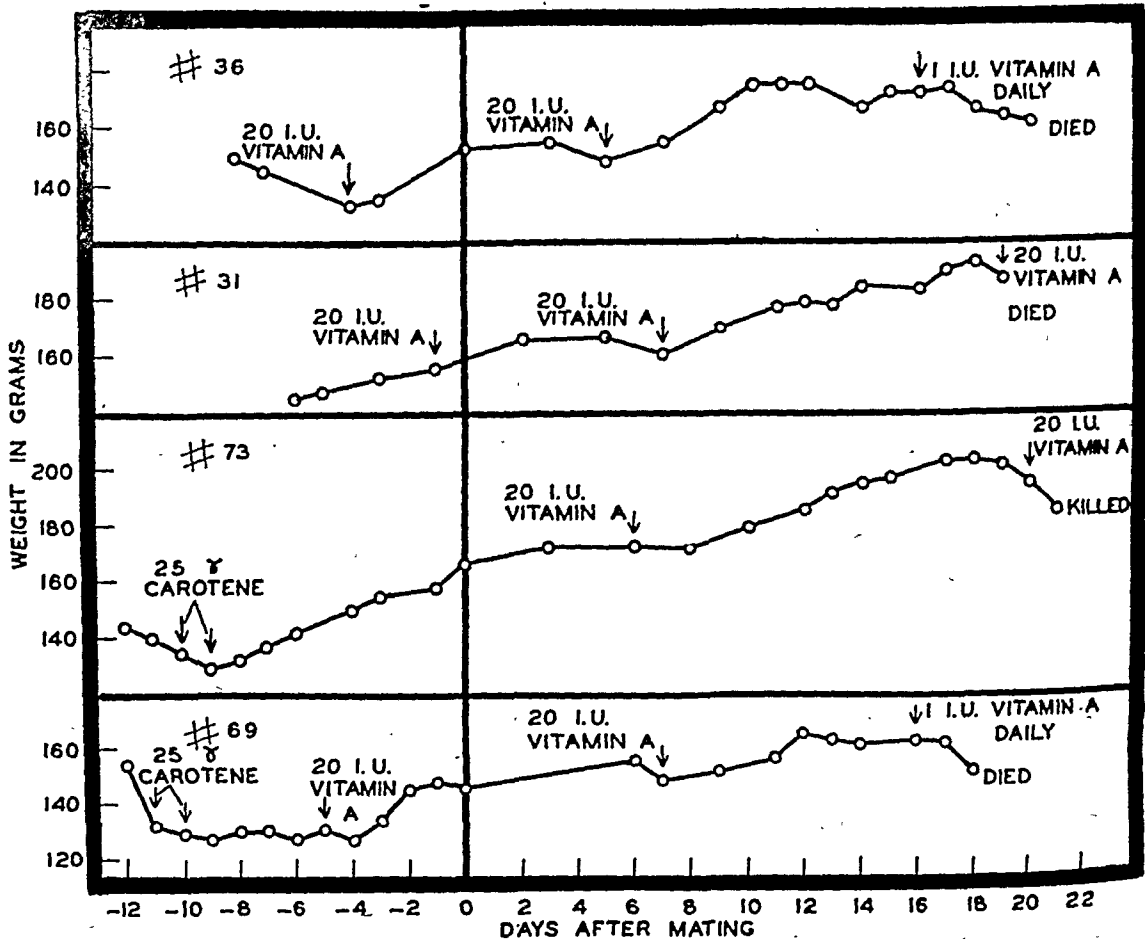


Fig. 1 (Jackson and Kinsey). Weight curve of four rats producing litters with abnormal eyes. Note growth response to additions of carotene or vitamin A.

example, there were no cases of young carried to term with the "open eyes" which Warkany and Schraffenberger described.

Second experiment. The object of the second experiment was to determine the maximal daily dose of vitamin A which, when given to females depleted of their vitamin stores, would result in development of eye abnormalities in the off-

groups and given daily doses of 2, 3, 5, or 10 I.U. of vitamin A daily.

The general condition of the animals in this experiment was superior to that in experiment 1. Moreover, they showed a more uniform physical state through the experimental period, presumably because they received vitamin A daily, rather than at 10-day intervals. Marked symptoms of ill-being were noted only at the end of pregnancy and seemed to be related to

difficult parturition or inability to deliver.

From the mothers receiving 2 I.U. of vitamin A daily, only one mature fetus was obtained. This fetus had normal eyes. The serum vitamin-A level in the mother on the 22d day of pregnancy was 24 I.U. per 100 ml.

Three litters were obtained from moth-

A per day were studied histologically. One of two fetuses sectioned from one litter showed abnormal retinal folding in the upper portion of one eye and a coloboma. One specimen from another litter also exhibited retinal folding and slight eversion of the retina. The four members of the other two litters studied had nor-

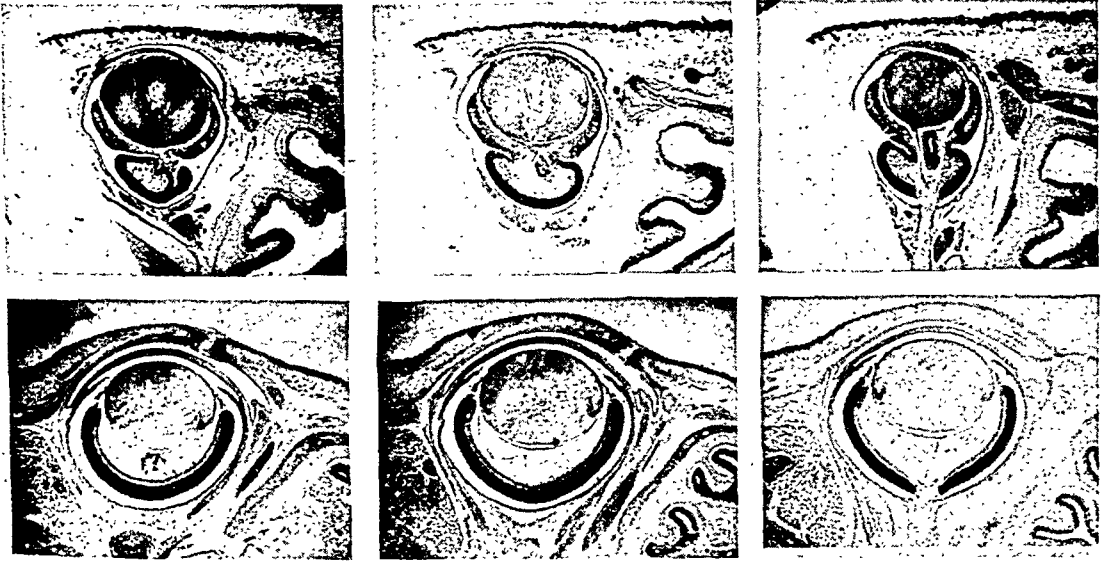


Plate I (Jackson and Kinsey). A, B, and C are transverse sections taken approximately one third, one half, and two thirds from the top of the eye, respectively, of an abnormal fetus about 19 days old. Sections D, E, and F are from a normal 19-day rat fetus.

ers receiving 3 I.U. daily. Of six fetuses in one litter, three had ocular abnormalities, including an orbital cyst (one case), retinal folding, and retrolental connective tissue. In the second litter, of four fetuses sectioned but one showed any abnormality, and this consisted only of retinal folding. Three of the eight young in the third litter were sectioned, and all three were found to be normal. The abnormalities consisted of retinal folding and retrolental masses of connective tissue, as may be seen from plate II. Serum vitamin-A levels of the three mothers in this group, taken at various times during pregnancy, ranged from 0 to 12 I.U. per 100 ml.

The eyes of four litters carried to term by mothers receiving 5 I.U. of vitamin

mal eyes. Serum vitamin-A values for these mothers on the 21st to 22d day of pregnancy ranged from 6 to 21 I.U. per 100 ml.

Three mothers receiving 10 I.U. per day produced young with normal eyes. Serum samples collected from the mothers 9 to 22 days after mating gave a range of 12 to 54 I.U. of vitamin A per 100 ml., the average being 35 I.U.

The results of this experiment indicate that ocular abnormalities are obtained from rats previously depleted of vitamin-A stores only when the dose of vitamin A does not exceed 3 to 5 I.U. per rat per day. Furthermore, the degree of abnormality appears to be related inversely to the daily intake, so that at the 5-I.U. level,

except for one case of coloboma, only abnormal retinal folding was observed.

Third experiment. In the previous experiments, the yield of mature live young with severe ocular malformations was very low. In addition to the high percentage of resorptions, many young died be-

the weanling stage were placed on the preparatory diet and given 12.5 micrograms of carotene every 10 days. The final dose before the change to the purified diet was double this amount. At the time the animals were put on the purified diet, daily supplements of 1 or 2 I.U. of vitamin A were begun. Control animals

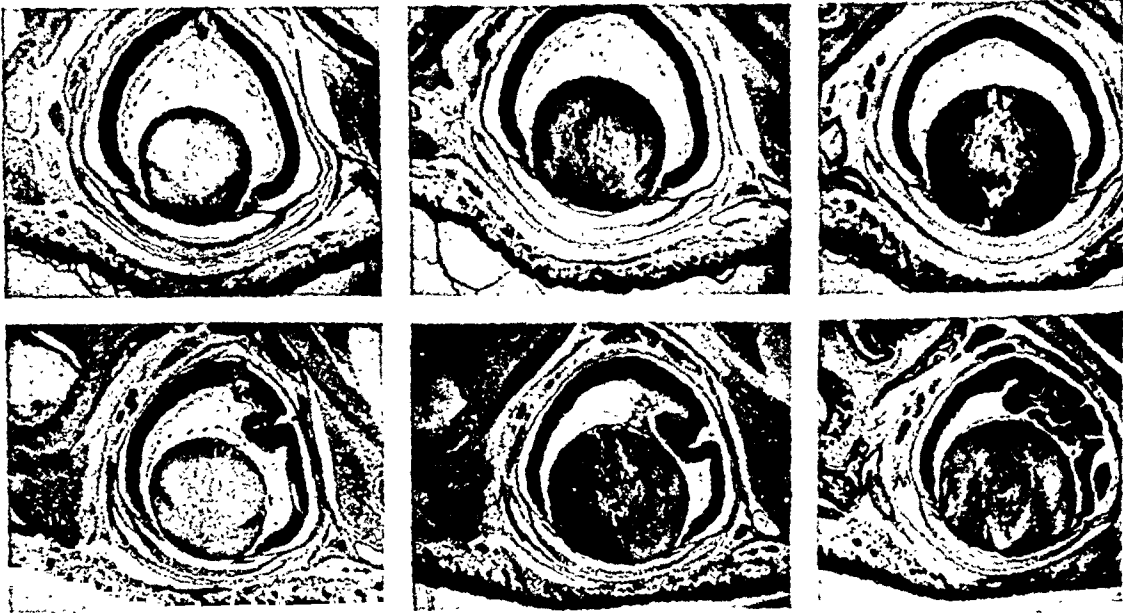


Plate II (Jackson and Kinsey). A, B, and C are transverse sections through an abnormal eye of a mature (22-day) rat fetus. Sections D, E, and F are from a control rat killed at birth (22-day gestation period).

cause the mothers were too depleted to deliver them. Since Warkany and Schraf-fenberger had observed the eye defects as early as the 15th day of fetal life, it was thought that the abnormal young might be carried to term and delivered by the mothers maintained on low vitamin A until the 15th day and then given adequate amounts of the vitamin. A second approach to the problem was suggested by Mason's finding that the resorptions occurring in vitamin-A deficient rats are indirectly associated with bacterial infection.⁵ In an attempt to offset this occurrence, the mothers were treated with sulfathiazole and with penicillin.

Two groups of rats were used for these experiments. In the first, 36 animals in

(five) were given 100 I.U. daily. On the 15th day after mating, the daily supplement to the low vitamin-A group was increased to 100 I.U.

Only one mature fetus was obtained for histologic examination, and this was taken by Caesarian section. It did show, however, the characteristic eye abnormalities. Analyses of the mother's serum vitamin A on the 0, 5, 10, and 15th days of pregnancy gave values of 12, 11, 5, and 10 I.U. per 100 ml., respectively. Somewhat higher values were obtained on other animals which resorbed their litters completely and at an earlier stage of gestation. Control animals delivered normal, live young.

The second group of animals received

12.5 micrograms of carotene throughout the preparatory period. They, too, received daily vitamin-A supplements of 1 or 2 I.U. after being changed to the purified diet. Some of the animals received sulfathiazole at a 1-percent level in the food for the first 15 days after mating. Others were injected with penicillin (500 Ox. u. in 0.1 ml. of vegetable oil) twice daily on the 8th through the 12th day after mating. On the 15th day of pregnancy, the mothers were changed from the purified diet to a commercial stock ration.

No full-term fetuses were obtained from the mothers kept on low levels of vitamin A during the first two weeks of pregnancy. Analyses of 19 blood samples collected during the first 15 days of pregnancy from seven mothers which resorbed their litters showed the average serum vitamin A to be 6 I.U. per 100 ml. (range 0 to 20). The average of 12 determinations on similar samples from five control animals was 51 I.U. (range 28 to 81).

Fourth experiment. In still another attempt to obtain live young showing eye abnormalities, female rats were allowed to grow normally to maturity on a complete stock ration and then depleted of their vitamin-A stores to varying degrees. The animals were put on the Warkany purified diet at 110 days of age. After periods of 5 to 13 weeks, they were mated. To keep the blood-vitamin-A level at a relatively constant value during the early period of pregnancy, some of the animals were given 1 or 2 I.U. daily. As in the previous experiments, additional vitamin A was supplied on the 15th day after mating. In the present experiments, this was accomplished by placing the animals on the commercial stock ration.

Complete data on this group are given in table 1. It will be observed that, from the 135 live young born, none showed

the eye abnormalities described by Warkany and Schraffenberger, although in two instances some retinal folding was observed (Nos. 169 and 190). The occurrence of this condition was probably related to the fact that the mothers of these two litters were severely depleted of vitamin A. In general, only essentially normal young were carried to term; mothers very low in vitamin A resorbed their litters. If the number of mothers depleted to such low levels associated with fetal resorptions had been greater, it is possible that a small percentage of abnormal litters might have been obtained.

DISCUSSION

Results cited previously have indicated that the ocular abnormalities occur only with daily vitamin-A allowances of less than 3 to 5 I.U. It is important to correlate the ocular defects with the various serum levels of vitamin A which were taken from time to time throughout the period of pregnancy. In all the animals producing young with abnormal eyes, the serum vitamin-A levels were less than 12 I.U. per 100 ml.; normal eyes were obtained when the maternal-serum vitamin-A level was only slightly greater than this. Thus, ocular defects occur in the young of rats having serum levels approximately one tenth or less of the normal.

It is worth noting that no vitamin-A deficient mothers seemed to be able to deliver their abnormal young. Although some defective fetuses may be carried to term, the amount of vitamin A required for successful parturition seems to be beyond the range of that associated with the production of ocular abnormalities.

Warkany and Schraffenberger reported that the vitreous was lacking in the abnormal eyes, the space which it would normally occupy being filled with the retrolental connective tissue. Although we

TABLE 1
DATA ON NUTRITIONAL EXPERIMENTS ON 19 FEMALE RATS

No.	Days on Deficient Diet at Mating	Daily Vit.-A Supplement, Days 0-15 of Pregnancy	Serum Vit. A—I.U. % Days after Mating					Notes on Pregnancy	Eyes of Offspring
			0	5	10	15*	20		
173	35	0	60	—	59	43	29	Delivered 9 dead young on 22d day.	Normal (histol. examination).
179	46	0	63	53	40	9	16	Delivered 10 live young on 23d day, 5 left with mother; 2 of these eaten, 3 weaned.	Normal (histol. exam. and exam. with ophthalmoscope of weanlings).
177	52	0	41	56	34	26	32	7 live young taken by Caesarian 24 days after mating.	Normal (histol. examination).
183	52	0	32	30	12	14	45	Delivered 7 live young on 23d day.	Normal (histol. exam. and exam. of weanlings with ophthalmoscope).
192	52	0	8	16	18	12	38	Delivered 7 live, 1 dead young on 23d day. Young left with mother were eaten.	Normal (histol. examination).
164	39	1 I.U.	61	61	—	—	41	Delivered 11 live young, late 22d day.	Normal (weanlings examined with ophthalmoscope).
161	41	1 I.U.	83	—	—	24	55	Delivered 8 live, 2 dead young, late 22d day.	Normal (weanlings examined with ophthalmoscope).
186	41	1 I.U.	—	—	32	21	52	Delivered 10 live young, late 22d day.	Normal (histol. exam. and exam. of weanlings with ophthalmoscope).
180	76	1 I.U.	6	—	8	18	—	Killed 15th day because of resorbing. 2 live, 1 dead fetuses.	No abnormality could be recognized at this stage.
182	40	2 I.U.	57	—	29	—	48	Delivered 6 live young, late 23d day, 2 of 5 left with mother died.	Normal (histol. exam. and exam. of weanlings with ophthalmoscope).
172	41	2 I.U.	66	47	—	41	62	Delivered 7 live young, late 22d day.	Normal (histol. exam. and exam. of weanlings with ophthalmoscope).
181	42	2 I.U.	53	—	26	16	55	Delivered 5 live young late 22d day	Normal (exam of weanlings with ophthalmoscope)
190	94	{ 1 I.U., days 0-15 } { 3 I.U., days 6-15 }	10	8	4	28	71†	Delivered 2 live, 4 dead young, 23d day. The 2 live young left with mother were killed.	Slight retinal folding (histol. examination).
178	77	{ 2 I.U., days 0-6 } { 0 I.U., days 7-14 }	19	16	—	—	—	Killed 14th day because resorbing. 14 resorption sites.	No abnormalities could be distinguished at this stage.
184	80	{ 1 I.U., days 0-9 } { 2 I.U., days 10-14 }	14	6	0	8	—	Killed 15th day because resorbing. 11 live, 2 dead fetuses.	
169	41	0 (throughout entire pregnancy.)	—	—	—	9	14‡	Delivered 5 live, 3 dead young. Mother killed 3 live young left with her.	
163	40	100 I.U.	63	65	—	—	40	Delivered 4 live, 6 dead on 23d day. 2 live left with mother were eaten.	Normal at weaning.
176	41	100 I.U.	41	—	41	45	71	Delivered 11 live young, 22d day.	Normal (histol. exam. and exam. of weanlings with ophthalmoscope).
189	42	100 I.U.	81	—	45	43	59	Delivered 10 live young, 22d day.	Normal at weaning.

* Put on Rockland rat pellets on 15th day of pregnancy.

† In addition to being changed to commercial rat pellets on 15th day, No. 190 received 100 I.U. vitamin A per day on days 15-23.

‡ No. 169 was maintained on the purified diet without any vitamin-A supplement throughout pregnancy.

also observed eyes where this occurred, in some instances the retrolental mass was considerably reduced and vitreous was present. This would appear to represent

one of the variations in degree of the effects produced by the vitamin-A deficiency.

Marked folding of the retina (or inner layer of the optic cup) is one of the most striking features observed in the abnormal eyes. In some cases, it reduces considerably the space which in normal eyes is occupied by the vitreous body. In many eyes, the folding seems to be definitely the result of overgrowth of this layer, a condition which could lead to the retinal eversion frequently observed. Retinal folding, especially in the upper part of the eye, seems to be the first abnormality encountered as one goes from completely normal eyes to those of increasing degrees of malformation.

SUMMARY AND CONCLUSIONS

Following techniques devised by Warkany and Schraffenberger, a group of 57 weanling female rats were grown to maturity without the accumulation of hepatic stores of vitamin A. They were then bred and given only minimal amounts of vitamin A during pregnancy. Four of the mothers carried their fetuses to advanced stages of development. The eyes of the young in these litters showed the abnormalities which have been described by Warkany and Schraffenberger.

To determine the limiting level of vitamin-A dosage in female rats producing young with abnormal eyes, similarly pre-

pared female rats were given 2, 3, 5, or 10 I.U. of vitamin A daily. They were then bred, and the supplement was continued at the same level. Young obtained from mothers fed less than 3 to 5 I.U. daily showed the eye defects already mentioned, whereas those receiving more than this amount of the vitamin all had normal eyes, even though the vitamin-A dosage was insufficient to allow normal delivery in many cases.

Serum vitamin-A values, taken during pregnancy from female rats producing young having abnormal eyes, were found to be less than 12 I.U. per 100 ml. in every instance (normal, 75 I.U. per 100 ml.). The addition of 100 I.U. of vitamin A daily or the feeding of a stock ration after the 15th day of pregnancy, with or without treatment with penicillin or sulfathiazole, did not reduce the high percentage of fetal resorption observed in the previous experiments.

It is concluded that ocular defects occur in the young rat only when the maternal vitamin-A deficiency is extremely severe, so advanced, in fact, that fetal resorption is common and normal birth is impossible.

To the extent that the physiologic processes associated with reproduction in human beings parallel those in the rat, it may be inferred that vitamin-A deficiency in the mother is not a probable cause of retrolental fibroplasia.

243 Charles Street (14).

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DISCUSSION

DR. CONRAD BERENS, chairman (New York) : This is a piece of research which is so vital in the prevention of blindness. We know that about 51 percent of blindness in the schools for the blind is caused by congenital abnormalities.

DR. DERRICK VAIL (Chicago) : Were there any skeletal malformations, especially in the optic foramen, base of skull, and so forth, observed?

DR. V. EVERETT KINSEY (Boston) : We have not yet examined the eyes or the animals for other defects including skeletal abnormalities, so I am unable to answer that question. Warkany, I believe, has described such defects in detail.

DR. VAIL : I should like to say just a few words, if I may. I want to inject here a note of warning. A few weeks ago, I testified in a criminal court case brought against a quack vitamin specialist who cited experimental work, reported in Iowa, on vitamin-D deficiency as a cause of anophthalmos in a litter of new-born pigs.

In his pamphlets, broadcast widespread to the public, he used the reports of these experiments to terrify pregnant women and urged them to buy his vitamin product as a prevention of blindness in the unborn child.

I should like to have, some place in the discussion, a firm statement to the effect that the results of your experiments are not yet applicable to human beings.

DR. KINSEY : I think our conclusion was to the effect that, in so far as the physiologic processes were the same in rats and in human beings, vitamin-A deficiency is not a probable cause of retrolental fibroplasia.

Even though we have to change our minds, I think, for the record, it might be well to be over cautious and say definitely that these results do not suggest that maternal vitamin-A deficiency is in any way associated with ocular abnormalities in infants.

DR. T. L. TERRY (Boston) : It is not intended to detract from this presentation, but I think it would interest you to know that pediatricians working on the problem of retrolental fibroplasia found clinically that this abnormality, which Jackson and Kinsey have reproduced, has developed in two infants whose vitamin-A blood level was kept normal by therapeutic measures. It may interest you further that, according to Clifford and Allers, vitamin A, when dissolved in oil, is not absorbed by the premature infant from the gastrointestinal tract, nor is it absorbed following subcutaneous or intramuscular injection. If the vitamin A is dissolved in glycerol instead of oil, they found that the level of the vitamin in the blood is elevated. In two infants who had received such injections, retrolental fibroplasia developed despite normal vitamin-A levels in the blood.

INTRAOCULAR MANIFESTATIONS OF ACUTE DISSEMINATED LUPUS ERYTHEMATOSUS*

REPORT OF A CASE

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(BY INVITATION)

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The paucity of adequate descriptions of the eyegrounds in instances of acute disseminated lupus erythematosus, with the exception of Maumenee's contribution, appears to be rivaled only by the infrequency with which such pertinent observations accompany reports of this disease in the medical literature. It is hopefully anticipated that an entity exhibiting such protean manifestations of a vasculo-allergic character be the subject of the integrated attention of the ophthalmologist, the internist, and of the dermatologist, each of whom, within his special field, encounters deviations from the normal. Many of these are exemplified in the following condensed case report.

B. L., an unmarried Jewess, aged 22 years, and of asthenic habitus, was admitted to the Presbyterian Hospital in October, 1938, with a history of recurrent fever and malaise for the preceding six weeks. She had had, however, frequent, migratory, multiple joint pains, chronic

pharyngitis, cervical adenopathy, leucorrhea, and intermittent fever during the two years since October, 1936, in which month the differing diagnoses of septic sore throat and scarlatina had been made by local physicians. Infectious arthritis also had been considered. There had been one bout of severe erythema of diffuse distribution of four to five days' duration six months prior to the patient's admission. The rash and temperature had subsided simultaneously. Exacerbations, however, tended to recur with the advent of cold weather and were accompanied by weakness and anorexia. General examinations, as well as symptomatic treatment by numerous local physicians, consistently yielded essentially negative results. Her past history was otherwise irrelevant.

A questionable systolic murmur at the apex, normal blood pressure, enlargement of a small tender lymph node in the right axilla, a thick malodorous leucorrhea, and a virginal introitus were the only positive findings on general physical examination at the time of admission to the Hospital. All of the indicated special examinations were made: X-rays of the chest, abdomen, viscera, and skeleton were negative; agglutination tests for hemolytic streptococcus (group A), typhoid, typhus, paratyphoid, and brucellosis were negative as was the Frei test; specific allergy testing was not undertaken, but intracutaneous testing for brucellosis and tuberculosis yielded

* From the Departments of Ophthalmology, Bellevue Hospital and New York University. Manhattan Eye, Ear and Throat Hospital. Presented at the eighty-first annual meeting of the American Ophthalmological Society at Hot Springs, Virginia, November, 1945.

Appreciation is expressed for the courtesy extended by the Department of Medicine, College of Physicians and Surgeons, Columbia University, for permission to present observations by the staff and the authors during their association with the Institute of Ophthalmology of the Presbyterian Hospital.

negative results. There was mild hypochromic anemia with moderate leucopenia (relative) and slight hemoglobinemia; no parasites were found in the blood or stool, and blood cultures were negative; serum protein was very slightly reduced, and there was a moderate hyperglobulinemia. The results of blood-chemistry tests were otherwise normal. Sedimenta-

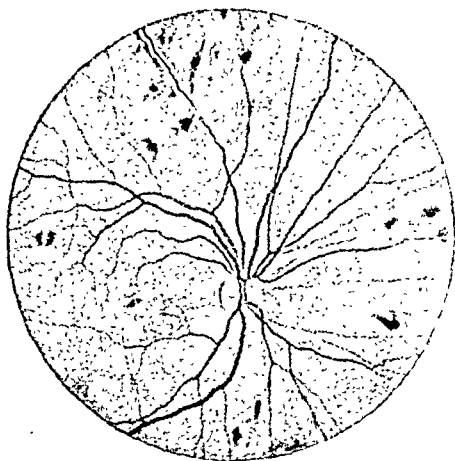


Fig. 1 (Koch and McGuire). O.D. drawing, February, 1939.

tion rate was 54 mm. in the first hour; urinalysis revealed slight albuminuria; and biopsy examination of the enlarged right axillary node revealed a mild nonspecific lymphadenitis, with no bacterial growth on culture.

The course under hospital and convalescent home care, until the patient's death on September 25, 1939, was essentially one of remissions and exacerbations of muscular and joint discomfort, elevation of the temperature to an occasional high level of 104°F., but of no characteristic type, upper respiratory infections and bronchopneumonia, maculopapular erythema of irregularly diffuse distribution, maintenance of normal diastolic and systolic blood pressures, abdominal pain with tenderness and spasm, mental irritation, and increasing apprehension as discomfort and diminishing vision progressed.

By gradual exclusion the clinical diagnosis of acute disseminated lupus erythematosus was decided upon approximately three months after the patient was admitted to the hospital. Laboratory findings, on frequent examinations, were somewhat variable, but the general trend during her illness continued to be one of increasing deviations from the normal in the directions indicated on the first tests performed after admission. The exception to this was the continued variability of the Kline and Wassermann reactions no matter what antigen was employed. Treatment included all suggested symptomatic aids, physiotherapy, sulfonamides, and the customary antisyphilitic agents, any one or all of which may have been without effect or may have initiated remissions or exacerbations. Autopsy permission was refused by the male parent.

Ophthalmoscopically, no observations were made except by the medical house officer (who reported the fundi normal on admission) until a complaint was made of blurred vision during an exacerbative bout of temperature elevation and discomfort. Then another medical house officer, three months after admission, thought that there was a haziness of the disc, nasally, but that the fundi otherwise seemed negative. Previously, shortly after admission, the medical resident had made a note of the conjunctival injection and the redness and edema of the lids.

Ophthalmologic examination was requested 3½ months after admission, after which there were periodic consultations by several observers, and fundus drawings were made. It was found on this first examination (fig. 1) that both optic discs were equally normal in color and demarcation and structurally were normally full. The fovea of the left eye and the macular areas of both were distinguishable as such. In general, the retinopathy found in the left eye was similar

to, but not so advanced as, that observed in the right. Here, numerous fine to larger, superficial hemorrhages of all types were seen in the relatively avascular macular and peripheral retinal areas as well as in other places where the retinal circulation was not obviously abundant. These hemorrhages, furthermore, were in close proximity to capillaries and to the smaller venules and arterioles, especially the former. There was marked periphlebitis slightly temporal to, and in the far periphery above, the disc. Segmental periphlebitis on a lesser scale was observable in the extreme peripheries, chiefly in the temporal quadrants. The general impression of a severe vasculitis was heightened by the presence of somewhat deep retinal and more superficial choroidal, roundish, gray-white exudates, the distribution of which was more irregularly diffuse than that of the hemorrhages. A group of older, partially absorbed exudates in the macular area was situated so deeply that it was believed they had their origin in the relatively lush vascular areolar area of the choriocapillaris. The general ophthalmoscopic impression recalled previous observations of such diffuse disease entities as periarteritis nodosa and, less typically, dermatomyositis.

Subsequent examinations revealed progressive intensification, but on a more extensive scale, of the retinopathy just described; however, the changes in the left eye continued to be proportionately less marked than those in the right. The vasculitis became more widespread and progressed proximally toward the disc; hemorrhages and exudates became more numerous but there continued to be some absorption of those previously present. One large subhyaloid hemorrhage occurred superiorly in the right eye but was absorbed within a few weeks, and a large oval hemorrhage nearly the size

of the disc appeared in the upper macular area in this eye. There occurred progressive obliteration of the lumen of the more peripheral retinal vasculature with complete replacement fibrosis manifested by yellowish-white connective-tissue cords traversing the original vascular channels and shading fairly abruptly into the still patent, more proximal vessels whether

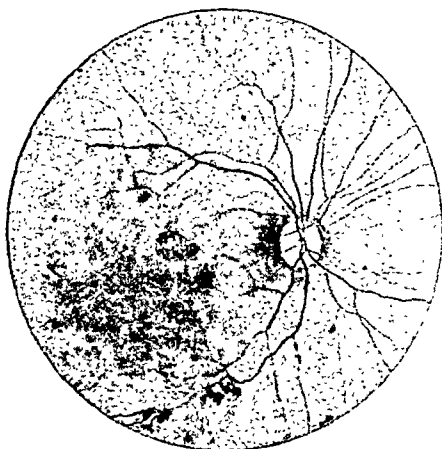


Fig. 2 (Koch and McGuire). O.D. drawing, June, 1939.

venous or arteriolar. There was primary optic atrophy in the right eye eight months after admission, when the second drawing was made (fig. 2) but this phenomenon still was in progress of development one month later in the left eye (fig. 3). The eyegrounds in general became mildly anemic in color.

Subjective ocular testing was not feasible because of the patient's discomfort and her lack of sustained coöperation, nor could additional drawings be made. As debasement of the general clinical findings progressed, further intensification of the described retinopathy occurred, and, although the changes in the left eye continued to lag somewhat behind those observed in the right, the conversion to fibrosed cords of previously normal vascular channels continued together with increasing optic-nerve atrophy and gradually decreasing hemorrhaging and exu-

dation. The retina became thinner, but the increase of diffuse, fine, granular, retinal pigmentation permitted no visualization of the choroid. Prior to death, light perception was lost in the right eye and was barely elicitable in the left. The media remained clear in each eye.

DISCUSSION

Speculation on the central etiology in this case with its widespread clinical

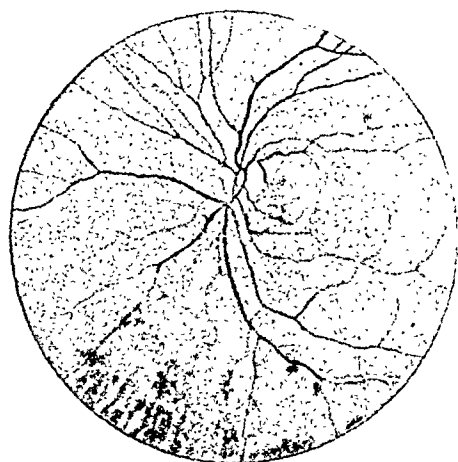


Fig. 3 (Koch and McGuire). O.S. drawing, July, 1939.

manifestations remains speculation in the deplorable and unfortunate absence of post-mortem examination; however, it is of interest to consider the opinions of two groups of observers in this connection. Klemperer, Pollack, and Baehr, recalling the thesis of Morgagni that diseases reside in certain organs, point out that we recognize the interdependence and unity of certain organs to form organ and tissue systems, and that entities such as acute disseminated lupus erythematosus and diffuse scleroderma, among others, may reasonably be considered as systemic diseases of the connective-tissue system with fibrinoid degeneration of the collagenous fibers and ground substance. These authors, although granting the possibility that fibrinoid degeneration of

collagen may result from hyperergic inflammation, do not believe that this type of degeneration always indicates a state of hypersensitivity. They feel that further investigation of the colloid system and its colloidal status must be made by biophysical and chemical methods.

The recent excellent review on the lupus-erythematosus concept by Stokes, Beerman, and Ingraham, Jr., stresses, on the other hand, the application of the "id" conception (tuberculids, syphilids, follicular "ids," *et cetera*) as that of allergic inflammation with its sequelae and homologies. Thus, it is suggested that "dissemination of a discoid or follicular erythematosus lupus (a lupo-erythematosid?) with the appearance of desquamative patches with follicular atrophy over other parts of the body, is simply an extension of the follicular 'id' beyond its conventional locus, under conditions affecting the general allergic state of the individual." Exacerbation and generalization may occur as the allergic base is broadened by some influence such as sulfonamide therapy or tuberculin skin testing or the physical allergen of actinic rays. If these allergic manifestations, or "id"-like processes, remain confined to the skin itself, the prognosis is not grave because of the well-known benignity of the disseminating discoid type of the disease. The reviewers then state: "*On the other hand*, in the hypersusceptible person—the infection-allergic type of individual, let us say—the epidermo-allergic or folliculo-allergic type of reaction that underlies the chronic discoid process may at a suitable provocation pass over (though only occasionally) into the field of vasculo-allergic manifestations and assume the far graver characteristics of the so-called acute disseminating type of the disease."

Thus, as they so succinctly point out: "The vasculo-allergic type of 'lupus ery-

thematosis' then, may be preponderantly local and cutaneous in its manifestations, or preponderantly systemic (fever, lymphadenopathy, leukopenia, absolute or relative, with or without thrombocytopenia, and with demonstrable vascular lesions, of the eyes, kidney and endocardium). It may be acute or chronic, or both. It may be combined with follicular 'id' lesions of discoid type and distribution, or not. The systemic vasculo-allergic lesions may come to notice first and dominate the picture to exitus." The reviewers strongly imply, moreover, that they are not in agreement with those dermatologists who believe that the absence of skin lesions is not uncommon and it is implied that a thorough search will not fail to reveal typical cutaneous lesions in this systemic disease.

In this connection, it is our opinion that early and thorough ophthalmoscopic examination is strongly indicated in all instances of "fever of unexplained origin" (one of the synonyms for acute disseminated lupus erythematosus) in pale, sickly, weak, asthenic women in their menstrual years. There also may be light sensitiveness, febrile episodes, with or without leucopenia, cutaneous petechiae, thinning hair, puffiness, and redness of the lids, arthritoid disturbances with re-

lief of pain by salicylates but with no corresponding temperature decline, and pleural, endocardial, and pericardial signs and symptoms but with negative blood cultures.

Few males, and then only in the years between puberty and early middle age, develop this disease. Stokes and his co-reviewers as well as the Mayo Clinic group hold pessimistic views concerning the effect of treatment of this condition; however, the former have discussed cautiously the possible benefit to be derived from induced menopause as considered by Rose. Indiscriminate but well-intentioned chemotherapy as a cause of exacerbation of a concealed systemic focus of infection might reasonably be avoided to some extent if early ophthalmoscopic examinations were made routinely whenever this type of disseminated erythematosus was suspected. It is our opinion that, although elevation of systemic blood pressure may ensue because of the nephritis present, the ophthalmoscopic differentiation between, or the coexistence of, the lupus and the hypertension should not be impossible if the intraocular findings, as indicated in this report, are considered as vasculo-allergic manifestations of widespread systemic, diffuse collagen disease.

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NUTRITIONAL AMBLYOPIA IN AMERICAN PRISONERS OF WAR LIBERATED FROM THE JAPANESE

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The purpose of this paper is to present the clinical picture of American soldiers liberated after an extended confinement in Japanese prison camps under conditions of severe malnutrition. The study was done on 33 soldiers captured in April and May, 1942, on Bataan and Corregidor, and liberated in early 1945. The development of early symptoms and findings was observed by one of us (S. M. B.) while a prisoner in Cabanatuan. The final and residual findings were observed by the other two collaborators while the patients were hospitalized in an Army eye center in the United States. During the period from liberation to arrival at this Eye Center, the patients had received an adequate diet and supplemental vitamin therapy and had returned to approximately their normal weight.

OBSERVATION OF PRISONERS OF WAR IN THE PRISON CAMP

Beginning in May, 1942, the survivors of the American forces of Bataan and

Corregidor were subjected to living conditions which led to malnutrition, various vitamin deficiencies, and starvation in the Japanese prison camps in the Philippines.

In the main, the diet consisted of about 300 gm. of polished rice plus a thin soup made of low-grade vegetables and weeds. Negligible amounts of fruit were occasionally furnished. Meat was almost completely lacking. Rarely, one pig would be furnished for a group of 2,500 men. After dressing and cooking, about all that would appear in the soup would be a bit of the hide and a few shreds of meat.

During the first four months of imprisonment, the men developed beriberi (both the wet and dry types), scurvy, pellagra, ariboflavinosis, and xerophthalmia, to mention a few of the clinical syndromes apparent. Naturally, the picture was that of a mixed avitaminosis in most cases, with one or other of the manifestations predominating. In addition, malaria, dysentery (amebic and bacillary), and diphtheria affected many. Of about 6,500

in Cabanatuan, 2,700 men died in the first year.

Blurring of vision began insidiously. It was first reported in September, 1942; that is, after about four months of starvation diet. The impairment of vision was described by most of the patients as an intermittent fading, more marked in bright sunlight. This process was gradual, and went unnoticed by many. After two to four weeks, retrobulbar pain and burning sensation in the eyes appeared in attacks during the later afternoon of bright sunny days, or during the early evening. These attacks were accompanied by photophobia and lacrimation. At that time, examination usually revealed no external gross alteration of the eyes; but in a few instances, mild injection of the conjunctiva was present. No visual test charts were available nor materials with which to make them; no lenses, no ophthalmoscopes, and practically no medicines, so that examination and treatment were extremely limited.

In October, 1942, the attacks of burning in and behind the eyes became more marked. It was then that the cornea was noted to be dry and roughened. After another day or two, superficial ulcers appeared. These were mostly round or oval in shape, over the pupil or lower half of the cornea, and usually single. Circumcorneal injection became evident. Unfortunately, no fluorescein or other staining drug was available at the time. In most cases, there was little infiltration of the cornea. Small amounts of cod-liver oil were obtained, and it was found that the ulcers healed after 4 to 10 days of its administration. However, the impaired vision persisted and, in most cases, progressed. A few of the corneal ulcers went on to perforation, or were complicated by hypopyon and iritis.

In November, 1942, a change of Japa-

nese administration brought an increase in the ration. Rice was increased to 400 gm., meat to 50 gm., and squash and comotes (a variety of sweet potato) were added. For the eye patients, 4 oz. of evaporated milk, and 4 oz. of carabao liver, when available, were added to the diet. The latter items seemed to have the most effect in arresting the development of corneal ulcers and in healing the manifestations of ariboflavinosis. By this time, also, a visual-test chart was made and batteries for an ophthalmoscope were obtained. Examination revealed pallor of the disc in the region of the papillo-macular bundle. Vision was reduced to 10/200 on the average, by December, 1942, and usually remained stationary thereafter, although in some cases, a slow decline continued. Central vision was most affected. Fields showed central and cecocentral scotomas, with moderate constriction of the peripheral fields.

At this point, one of us (S. M. B.) was transferred to Santo Tomás, a camp for Allied civilian internees. Here an opportunity arose to observe the effect of early treatment in conditions similar to those afore described. These people had fared better up to that time by being allowed to receive or purchase food from the neutrals and Filipinos outside. They were not dependent on the Japanese ration, which was just as inadequate as at Cabanatuan. However, the Japanese closed all traffic with outside sources on February 1, 1944, and by May, patients were complaining of photophobia, retrobulbar pain, and diminution of vision, particularly in bright light. Small supplies of thiamin chloride were available from the American Red Cross shipment of August, 1943 (delivered to the internees January, 1944), so that we were able to give 25 mg. daily for two to three weeks to affected individuals. This dosage served to check

the progress of the disease. Multiple vitamins were given along with injections of the thiamin. A patient who had lost 80 pounds in 12 months at Fort Santiago (Political Military Prison) and who had developed beriberi as well as a diminution of vision to 10/200 with central scotomas, made a fair recovery over a period of eight months during which he was treated as has been outlined. By November, 1944, he was able to read large print and his own handwriting. His vision returned to 20/70. In December, 1944, be-

Hospital with complaints of: (1) decreased vision in both eyes, (2) inability to see an object when using central vision, (3) burning and pain in the extremities.

On admission to this Hospital, his appearance was that of a well-developed and well-nourished man. (His history has been related.) The physical examination performed by the Medical Service showed no abnormalities or variation from normal. Neurologic examination was entirely negative except for: (1) peripheral neuritis and (2) optic atrophy, bi-

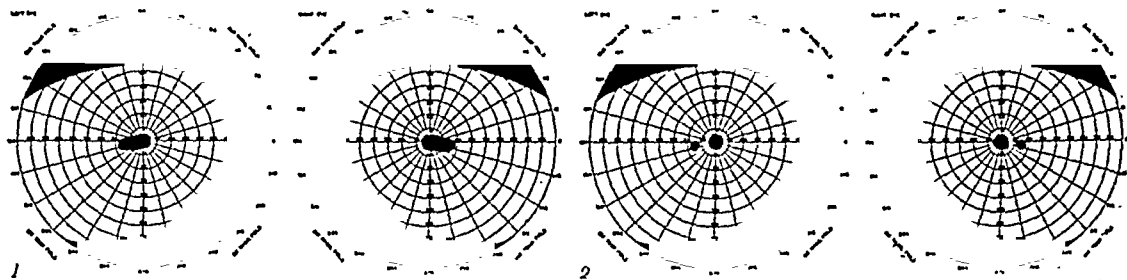


Fig. 1. (Bloom *et al.*). Central fields in a typical case—0.5° target.

Fig. 2. (Bloom *et al.*). Central fields in a typical case—1° target.

cause of the marked starvation (the diet was down to 200 gm. of polished rice daily), his vision began to deteriorate again.

In Santo Tomás, colored visual fields were charted. Patients showed earliest changes in the blue field; then changes in the red and green fields, enlargement of the blind spot, constriction of peripheral fields; later, central or cecocentral scotomas became evident.

OBSERVATION OF LIBERATED PRISONERS IN THE EYE CENTER

To give a detailed report on each case studied at this Eye Center would be unnecessary repetition, for all the cases fall into a uniform pattern in their essential findings. These data will be presented in the chart, showing the minor variations in each case.

Typical case. The patient entered the

lateral. Laboratory work consisted of: (1) basal-metabolism rate, (2) electrocardiogram, (3) blood chemistry, (4) electro-encephalogram, (5) cephalin flocculation, (6) X ray of lungs and heart, (7) routine urinalysis, (8) blood count, (9) serum reactions. All of these tests were normal. Stool examination revealed intestinal parasites.

The eye examination was as follows: The external examination revealed normal lids, conjunctiva, sclera, and cornea. The lacrimal apparatus was patent, and tactile tension normal. External ocular movements were full, and the pupils reacted to light and accommodation. No lacrimation or photophobia was present. On slitlamp examination, the cornea appeared normal, with no increase in limbal vascularization, no degeneration, no thinning, and no xerosis. The iris stroma, lens, and anterior vitreous were normal

throughout. The anterior chamber was of normal depth; the aqueous ray was absent. No cells were seen. With well-dilated pupils, the ophthalmoscopic examination showed clear media. No elevation nor abnormal excavation of the optic-nerve head was seen. The edges were clearly defined and distinct. The temporal portion of the disc showed a definite pallor, whereas the nasal portion was relatively normal. The vascular tree was normal, and the periphery of the fundus revealed no pathologic lesions. The macular area appeared normal in approximately 60 percent of the cases and mottled in 40 percent. Vision in each eye was 20/200, not correctable. The peripheral fields showed mild, generalized constriction, but were not remarkable. The central fields showed a central scotoma of 5 to 8 degrees, with a 1-degree target under good illumination, and a centrocecal scotoma, either absolute or relative, with a 0.5-degree target. The scotomas were larger for colors than for white.

A diagnosis was made of optic atrophy secondary to nutritional deficiency.

Treatment consisted of a high-vitamin, high-caloric diet, supplemented by daily administration of six multivitamin capsules, thiamin (50 mg., intramuscularly), and riboflavin (10 mg.). This treatment was instituted for a 60-day period. After this course of treatment, a reexamination showed no change in any case.

COMMENT

The description given is that of a typical case, and the following discussion will deal with the variations.

Cornea. Five patients showed small corneal scars resulting from ulcers that occurred in 1942, and one showed a complete leucoma following a perforating ulcer suffered at that time. All other corneas were clear.

Discs. The color of the discs varied from a minimal temporal, to almost complete pallor, but the vast majority showed only mild temporal pallor. The most striking feature was the lack of correlation between the visual acuity and the extent of the optic atrophy.

Maculas. The maculas, as has been stated, were normal in 60 percent of the cases, while 40 percent showed macular mottling and loss of foveal reflex.

Central fields. The central fields (figs. 1, 2) varied only in size and in the density of the scotomas, the latter depending on the severity of the condition.

Vision. The vision varied from 20/40 to 2/200 and varied directly with the density of the scotoma.

Extrinsic factors. As seen in the chart, there were many factors which had a definite influence on the final vision retained. These factors were as follows: (a) Patients having the most severe cases of malnutrition died; at this Center we dealt with the less severe cases. (b) Of this group, the men from Bataan seemed to have suffered more than the men captured on Corregidor because of the lack of supplies to the Bataan force prior to capture. They showed definite signs of malnutrition and early beriberi before surrendering, but had no eye complaints that we know of. (c) The diets of the various prison camps played a paramount role in determining the end result. At Bilibid and Cabanatuan, the diets were most deficient, consisting mostly of rice and soup from cancong weed. Here the inmates showed the most marked pathologic changes. At the other extreme, prisoners at some camps in the southern portion of Japan proper showed much less change because their rice diet was supplemented with fish, fresh fruit, and occasional meat. It is interesting to note that three patients with no pathologic eye findings (not included

TABLE 1
THE FINDINGS IN 33 AMERICAN SOLDIERS LIBERATED FROM THE JAPANESE

Cornea	Nerve head	Fundus	Peripheral Fields	Central Fields	Vision	Diet Supplement	Camps	Onset of Visual Symptoms
1. Normal	Mild temp. pallor	Macular mottling	Normal	Central scotoma	20/200 20/50	No vitamins Mukden diet good	Cabanatuan Mukden	Nov. 1942
2. Normal	Temp. pallor	Normal	Mild constrict.	Centro-cecal scotoma	20/70 20/70	Few vitamins	Wawa	July 1942
3. Macula OD Normal OS	Mild temp. pallor	Normal	Mild constrict.	Central scotoma	20/200 8/200	Few vitamins	Death march Cabanatuan Japan	Oct. 1942
4. Normal	Mild temp. pallor	No foveal reflex	Normal	Central scotoma	20/100 20/100	Few vitamins	Cabanatuan	Oct. 1942
5. Normal	Mild temp. pallor	No foveal reflex	Normal	Centro-cecal scotoma	20/50 20/200	Few vitamins Davao diet good	Death March Davao Korea	July 1942
6. Normal	Mild temp. pallor	No foveal reflex	Normal	Centro-cecal scotoma	20/100 20/100	Few vitamins	Cabanatuan	Jan. 1942
7. Nebula OD Leucoma OS	Temp. pallor OD Fundus not seen	Normal OD	Normal	Centro-cecal scotoma	20/100 H.M.	Thiamin Nov. 1942 Mukden diet good	Death March Cabanatuan Mukden	July 1942
8. Normal	Temp. pallor	No foveal reflex	Mild constrict.	Central scotoma	20/200 20/200	Few vitamins	Cabanatuan Bilibid Fort McKinley	Sept. 1942
9. Normal	Temp. pallor	No foveal reflex	Normal	Central scotoma	20/100 20/200	Thiamin 1942	Cabanatuan Korea Japan	Sept. 1942
10. Normal	Mild temp. pallor	Normal	Normal	Centro-cecal scotoma	20/70 20/100	Few vitamins	Cabanatuan	Nov. 1942

TABLE 1 (Continued)

Cornea	Nerve head	Fundus	Peripheral Fields	Central Fields	Vision	Diet Supplement	Camps	Onset of Visual Symptoms
11. Normal	Mild temp. pallor	Normal	Mild constrict.	Centro-cecal scotoma	20/70 20/200	Vitamins in Hosp.	Cabanatuan Bilibid Hosp. July 1944 Japan	Nov. 1942
12. Nebula OD Normal OS	Marked temp. pallor	Normal	Normal	Central scotoma	20/100 20/200	No vitamins	Cabanatuan Japan Nov. 1942	Nov. 1942
13. Nebula OD Normal OS	Temp. pallor	Normal	Normal	Small central scotoma	20/200 20/100	None	Cabanatuan Japan May 1943	Jan. 1943
14. Normal	Mild temp. pallor	Normal	Mild constrict.	Central scotoma for color	20/40 20/40	Five months of vitamins	Bilibid Cabanatuan Japan 1944	Mar. 1943
15. Nebula OD Normal OS	Moderate temp. pallor	Normal	Normal	Central scotoma	20/100 20/100	Thiamin in Hosp. in Bilibid	Cabanatuan Bilibid Hosp. Japan 1943	Oct. 1942
16. Normal	Temp. pallor	Normal	Mild constrict.	Central scotoma	20/200 20/200	None	Cabanatuan	Oct. 1942
17. Normal	Temp. pallor	Macular mottling	Normal	Central scotoma	6/200 4/200	None	Cabanatuan	Oct. 1942
18. Normal	Compl. pallor	Macular mottling	Mild constrict.	Central scotoma	5/200 10/200	None	Bilibid	Jan. 1942
19. Normal	Temp. pallor	Normal	Normal	Central scotoma	20/200 20/200	None	Cabanatuan	Aug. 1942
20. Normal	Compl. pallor	Normal	Normal	Central scotoma	1/200 1/200	Six months of thiamin	Cabanatuan Bilibid	Oct. 1942
21. Normal	Mild temporal pallor	Normal	Normal	Central scotoma	L.P. L.P.	None	Cabanatuan Bilibid	Sept. 1942

TABLE 1 (Continued)

Cornea	Nerve head	Fundus	Peripheral Fields	Central Fields	Vision	Diet Supplement	Camps	Onset of Visual Symptoms
22. Normal	Temp. pallor	Macular mottling	Mild constrict.	Central scotoma	3/200 3/200	None	Cabanatuan Bilibid	July 1942
23. Nebula OD Normal OS	Temp. pallor	Normal	Mild constrict.	Centro-cecal scotoma	20/100 10/200	Few vitamins	Cabanatuan Bilibid	Sept. 1942
24. Normal	Temp. pallor	Normal	Normal	Central scotoma	20/200 10/200	None	Cabanatuan	Dec. 1942
25. Normal	Temp. pallor	Normal	Mild constrict.	Centro-cecal scotoma	20/200 10/200	None	O'Donnell Cabanatuan	Nov. 1942
26. Normal	Temp. pallor	Mac. mottling OD Normal OS	Normal	Centro-cecal scotoma	20/200 10/200	None	Cabanatuan Bilibid	Oct. 1942
27. Normal	Temp. pallor	Normal	Normal	Central scotoma	10/200 10/200	Few vitamins	Cabanatuan	Oct. 1942
28. Normal	Temp. pallor	Normal	Normal	Central scotoma	5/200 10/200	None	Cabanatuan	Oct. 1942
29. Normal	Temp. pallor	Macular mottling	Mild constrict.	Centro-cecal scotoma	1/200 2/200	None	Cabanatuan Davao	Oct. 1942
30. Normal	Temp. pallor	Normal	Normal	Central scotoma	20/200 8/200	None	Cabanatuan	Oct. 1942
31. Normal	Moderate temp. pallor	Normal	Normal	Centro-cecal scotoma	5/200 5/200	None	Cabanatuan Bilibid	Oct. 1942
32. Normal	Temp. pallor	Macular mottling	Mild constrict.	Relative central scotoma	20/100 20/70	Few vitamins	O'Donnell Cabanatuan Japan	Oct. 1942
33. Normal	Temp. pallor	Normal	Mild constrict.	Central scotoma	20/200 20/100	Few vitamins	Cabanatuan	Oct. 1942

in this report), were imprisoned in camps where the diet approached normal. In most camps, the rice served was polished. However, in at least one instance, the rice polisher broke and unpolished rice was served for two months. A definite improvement in the condition of the men resulted during this time. On returning to the diet of polished rice, they suffered a recurrence of former symptoms. The men state that the prisoners who refused to eat the cancong soup, and those bartering their food for cigarettes, suffered more severely than others.

Another important factor was the presence of severe malaria, dengue fever, and dysentery (bacillary and amebic). These diseases caused marked debility and anorexia which prevented the ingestion of what little food was allowed them.

From time to time, the men were able to supplement their diets with vitamins obtained in various manners, and a temporary improvement in their condition was noted at such times. The most striking example of this was seen when a marked improvement in symptoms among all prisoners followed the administration of a small amount of Red Cross supplies in December, 1943.

DISCUSSION

A group of patients is presented that has had an extremely unusual and unfortunate experience. These men have been under conditions of malnutrition and avitaminosis for a long period of time and give accurate histories of severe loss of weight, extreme weakness, and symptoms of diseases due to lack of food and vitamins. Since liberation, they have all been on diets high in calories and rich in vitamins, with recovery from all symptoms except those referable to nerves and eyes.

During the onset and development of amblyopia (from May, 1942, to November, 1942), their diet consisted of from 200 to 400 gms. of polished rice a day and watery soup made from cancong weed. Later, small amounts of other vegetables, fruit, fish, and meat were added, but the diet was always far from adequate. Polished rice is very low in thiamin (trace to 0.5 μ mg. per gm.), and the cancong soup contained a negligible amount. Two hundred to 400 gm. of rice furnish approximately 700 to 1,400 calories, so that the total caloric intake per day was probably 900 to 1,600 calories. Not only was the caloric intake low, but the ratio between thiamin ingested and total amount of calories consumed was also abnormally low. Cowgill,¹ in 1934, showed that a definite relationship should exist between total caloric intake and thiamin ingested, and that when this is not normal, symptoms of deficiency developed. Besides this abnormal relationship there was another. In "Vitamin therapy" by Gordon and Severinghaus,² it is stated that the thiamin requirement of man is dependent on the proportion of fat to carbohydrate in the diet. Fat has a thiamin-sparing action, whereas carbohydrate increases the need for thiamin. On looking at the diet described, we find rice to have 79.3-percent carbohydrate, 0.26-percent fat, 7.1-percent protein; therefore, the need for thiamin is very apparent. In 1942, at Mayo Clinic, Williams, Mason, Smith, and Wilder³ gave the requirements of thiamin for man. They stated that, on .07 mg. thiamin per 1,000 calories, patients had weight loss and noted increasing weakness. They also found that the minimal daily requirements of thiamin for man was between 0.22 and 0.50 mg./1,000 calories providing CHO/fat ratio was normal. The diet these men were on had insufficient thiamin requirements, had an

abnormal thiamin/caloric ratio, and an abnormal fat/CHO proportion which necessitated increased thiamin. This all shows that a definite thiamin deficiency was present.

Another observation to be made is the similarity of our findings to those of Carroll's^{4,5} and Johnson,⁶ who reported cases of tobacco-alcohol amblyopia which they believed due to thiamin deficiency. In both conditions, we see defective vision, central or cecocentral scotomas, normal peripheral fields, and temporal pallor of the optic-nerve head. In one paper,⁵ Carroll suggests that the amblyopia could be a "manifestation of a deficiency condition without toxic elements" or could be due to "toxic action of tobacco on malnourished cells." He further suggests that when B₁ is added, the nutrition of the damaged cells, or perhaps their axons, improves, and the injurious agent is no longer injurious. He also shows improvement in vision and fields on thiamin therapy. Our findings sustain the first premise, for no toxic element was apparently concerned. In another paper,⁴ Carroll shows a case in which the eye findings were almost identical to ours and which unquestionably improved on thiamin therapy.

Thiamin therapy was tried in all our cases but the results were poor. It is believed they were thiamin deficient so long that irreversible changes had taken place in the optic nerve. The peripheral neuritis in the extremities was not relieved, probably for the same reason. However, some of the patients not included in this report, because they were not blind, improved under parenterally administered thiamin therapy when given in early stages of the deficiency. Sufficient amounts were not available to treat all prisoners.

It is of interest to note that Moore⁷

describes a syndrome of misty vision, photophobia, and optic atrophy associated with glossitis, perleche, and itchy, scaly scrotum along with neuritic changes which closely resembled this disease in early stages. These patients were African sugar-plantation workers whose diet was very deficient. After the pellagra and ariboflavinosis cleared, vision, as well as symptoms of peripheral neuritis, remained unimproved. The symptoms and final end results closely resemble those experienced in the prison camps.

It is of possible importance that the men in our prisoner-of-war series claimed better vision in dim light, as in evenings, than in ordinary daylight. This is contrary to what one would expect in vitamin-A deficiency and, although adequate amounts of cod-liver oil were available and given, it failed to arrest the declining vision, which was evidence that some other factor was responsible. However, the vitamin A did result in healing of the corneal ulcers. The central scotomas, photophobia, and lacrimation were responsible for the poor vision in bright light. At night, the uninvolved retina would be expected to function more or less normally.

SUMMARY

The early eye findings in American soldiers while in Japanese prison camps and residual findings in some of these men after liberation have been presented. The following conclusions are drawn:

1. Malnutrition due to a deficient diet can cause an optic atrophy manifested by defective vision, central or centrocecal scotomas, and pallor of the nerve head.

2. The deficiency seems to be due to a lack of vitamin B₁, since the diet, in every case, was highly deficient in this vitamin; the symptoms occurred coincidentally with beriberi; and the symptoms were re-

lieved by thiamin when administered in the early stages of the deficiency.

3. If treatment is not instituted early enough, the condition becomes irreversible, as witnessed by the lack of improvement after administration of intensive vitamin therapy at this Center.

4. The loss of vision and the size of the central scotomas were not in direct proportion to the amount of optic atrophy seen.

5. The appearance of the disc varied from minimal to complete atrophy, with

the vast majority of eyes showing mild temporal pallor.

6. The maculas had a normal appearance in 60 percent of the cases and a mottled appearance with loss of the foveal reflex in the remainder.

7. The nerve involvements—peripheral neuritis and optic atrophy—were the only residual abnormal findings made at this Center on patients who had suffered severe malnutrition over a period of years.

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CHANGES IN THE ANGIOSCOTOMAS ASSOCIATED WITH THE ORAL ADMINISTRATION OF EVIPAL*

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INTRODUCTION

For some time ophthalmologists have been concerned with the question as to whether barbiturates are contraindicated in the treatment of patients with glaucoma. This concern has derived to a great extent from the fact that large doses of barbiturates have been known to produce a dilation and to increase the permeability of the cerebral blood vessels and capillary bed.^{1, 2}

With a suitable method, one could study the effect of an orally administered barbiturate upon the retinal vascular system. Angioscotometry was chosen as a suitable method for this experiment, since changes in the normal angioscotoma are assumed to represent alterations in the functions of the retinal perivascular space.

METHODS AND MATERIAL

The word "angioscotoma" signifies a "defect in the visual field related in form to the pattern of distribution of the retinal vessel tree."³ These shadows (after extensive research) have been interpreted as arising because of modifications of the retinal perivascular spaces and in the retinal synaptic junctions.⁴

Technique. The scotoma was mapped according to the method advocated by Evans.⁵ The defects in the visual fields

could thus be studied both qualitatively and quantitatively.

The Evans stereocampimeter and charts were used. Monocular fixation was employed throughout the experiment. The diameter of the spherical, white test object used was in all cases 0.4 mm. (illumination of the test chart was approximately 15 foot-candles). The blind spot of Mariotte was outlined. Then the two main superior angioscotomas were plotted by moving the object from seeing to blind, care being taken at all times to move the test object at right angles to the border of the defect.

Subjects. Ten studies were carried out on 10 different subjects, 9 female and 1 male. The ages of the subjects ranged from 21 to 26 years. All known causes for alteration of the angioscotoma were carefully eliminated. Each subject was found to be in good health.

Procedure. The subjects rested for approximately ten minutes before any mapping was begun. During this period the pulse and blood-pressure values were recorded. The subjects were familiarized with the apparatus and instructed to respond either by tapping with a pencil or by saying "gone" to indicate the disappearance of the test object. The first map or control was then plotted. The subject then took orally a tablet containing 4 gr. of evipal.[‡] This particular drug was employed because evipal is a rapidly acting barbiturate. Four grains is an average

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[‡] Evipal is N-methylcyclohexenylmethyl barbituric acid.

adult hypnotic dose.¹ A second chart was plotted 30 minutes after ingestion of the tablet in order to allow time for beginning absorption. The pulse and blood-pressure values were again recorded. This same technique was employed at

demonstrable alteration of the scotoma. There was no change in the area of the blind spot. Pupillary changes were not detectable by available methods. The first effects of the drug were noted from 30 to 45 minutes after the barbiturate had been

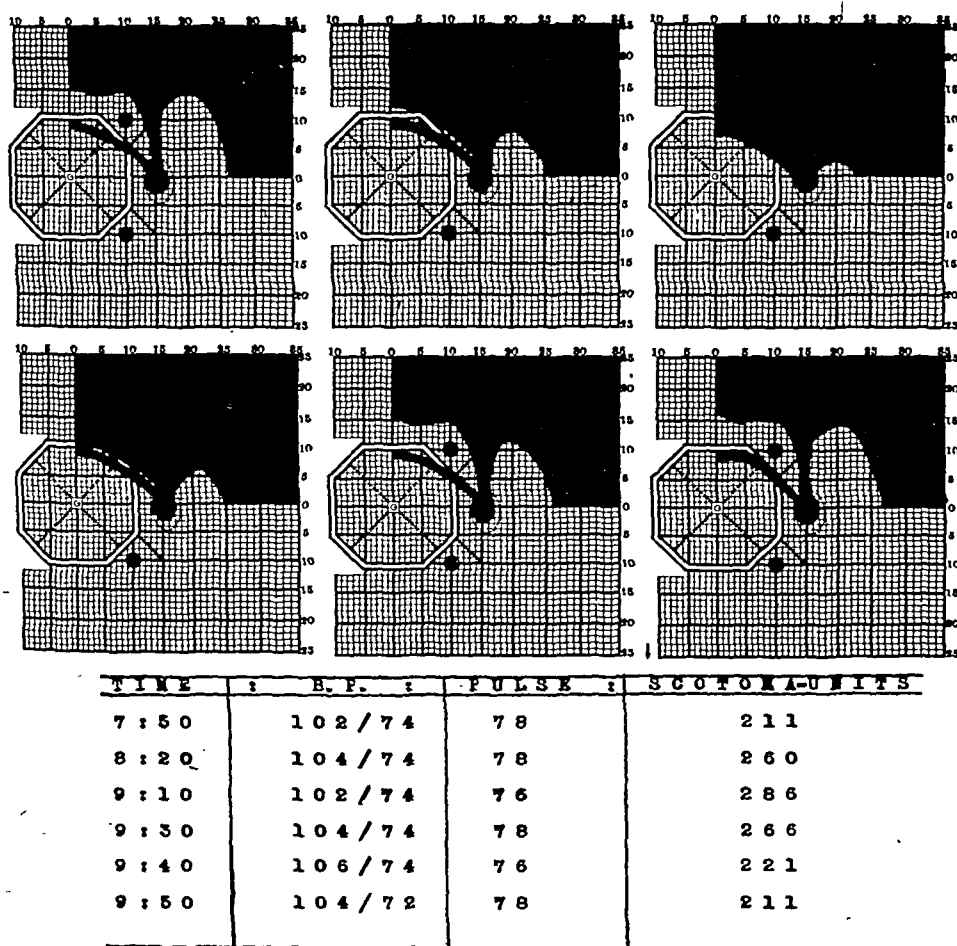


Fig. 1 (Fink). Angioscotomas plotted to show the effects on a subject (C. M.) after oral administration of evipal.

15- to 20-minute intervals until the control stage was once again reached.

OBSERVATIONS

The accompanying charts, table, and graph illustrate the observations made with the subjects. A widening of the angiogram was associated with the oral administration of evipal in 8 of the 10 subjects. The other two showed no

taken. The average time was 35 minutes. Maximum effects were obtained from 45 to 105 minutes following ingestion. The average time was 70 minutes. The effect was lost in 90 to 205 minutes after oral administration, the average time being 149 minutes.

No subjective sequelae, such as psychic depression, were noted in any of the subjects. The effect on the blood-pressure

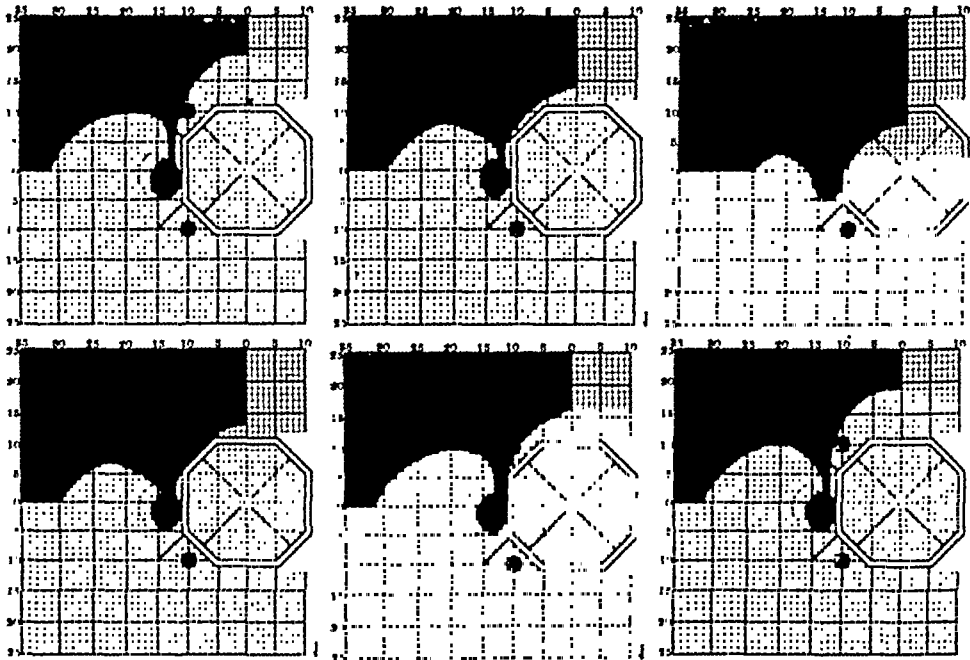
and pulse rate did not vary significantly so far as could be observed.

COMMENT

In attempting to evaluate what was observed in this experiment, it will be necessary to state what is thought to be the

a fuse to protect the rod-and-cone layer (neurogenic or nerve-fiber-bundle hypothesis).⁵

2. The disturbance of the normal physiology of the retinal perivascular system (angiogenetic or perivascular-space hypothesis).⁵



TIME	B. P.	PULSE	SCOTOMA UNITS
8 : 00	140 / 90	72	200
8 : 50	140 / 88	70	242
9 : 45	140 / 84	66	292
10 : 25	136 / 86	68	250
11 : 05	138 / 82	72	216
11 : 25	138 / 86	68	200

Fig. 2 (Fink). Angioscotomas plotted to show the effects on a subject (M. N.) after oral administration of evipal.

origin of the alteration of any angioscotoma.

The influencing factors are thought to be:

1. Anything that would interfere with the conductivity at the synaptic junctions, because in the presence of deleterious agents the synaptic junctions may act as

3. The autonomic nervous system which relates the first hypothesis to the second.⁵ (Basic studies have been duplicated over the world by many workers and have been found in agreement.)

Evidence has been found in the literature to suggest that possibly each of the foregoing factors, in itself, may be con-

TABLE 1

APPEARANCE AND DURATION OF CHANGES IN THE SCOTOMA PRODUCED BY EVIPAL

Subject	First Change	Max. Effect	Effect Lost
	<i>min.</i>	<i>min.</i>	<i>min.</i>
P.H.	30	75	150
A.M.	0	0	0
C.M.	30	80	120
W.B.	35	55	170
A.G.	30	80	160
M.B.	30	60	140
A.F.	45	45	90
G.L.	30	60	160
J.B.	0	0	0
M.N.	50	105	205
Average	35	70	149

sidered as a partial explanation as to why the alterations of the angioscotomas took place in this experiment:

1. Microscopic sections of the brain from fatal cases of barbiturate poisoning have shown "a swelling or tumefaction of the ganglion cells."⁶ This observation

would lend support to that part of the neurogenic hypothesis.

2. In the introduction of this paper, it was stated that large doses of barbiturates have been known to produce a dilation and increase the permeability of the cerebral blood vessels and capillary bed.^{1, 2} It would not be unreasonable to assume that this dilation and increased permeability would alter the physiology of the perivascular space. This observation would then add support to the angiogenetic or perivascular-space hypothesis.

3. In studying the effects of evipal on the parasympathetic nervous system, Emelin has noted that "the effects are very similar to those caused by atropine. Evipal diminishes the responses obtained through a stimulation of the cholinergic nerves. It also counteracts the muscarine-like effects of acetyl-choline."^{7, 8} The parasympathetic nervous system, it seems,

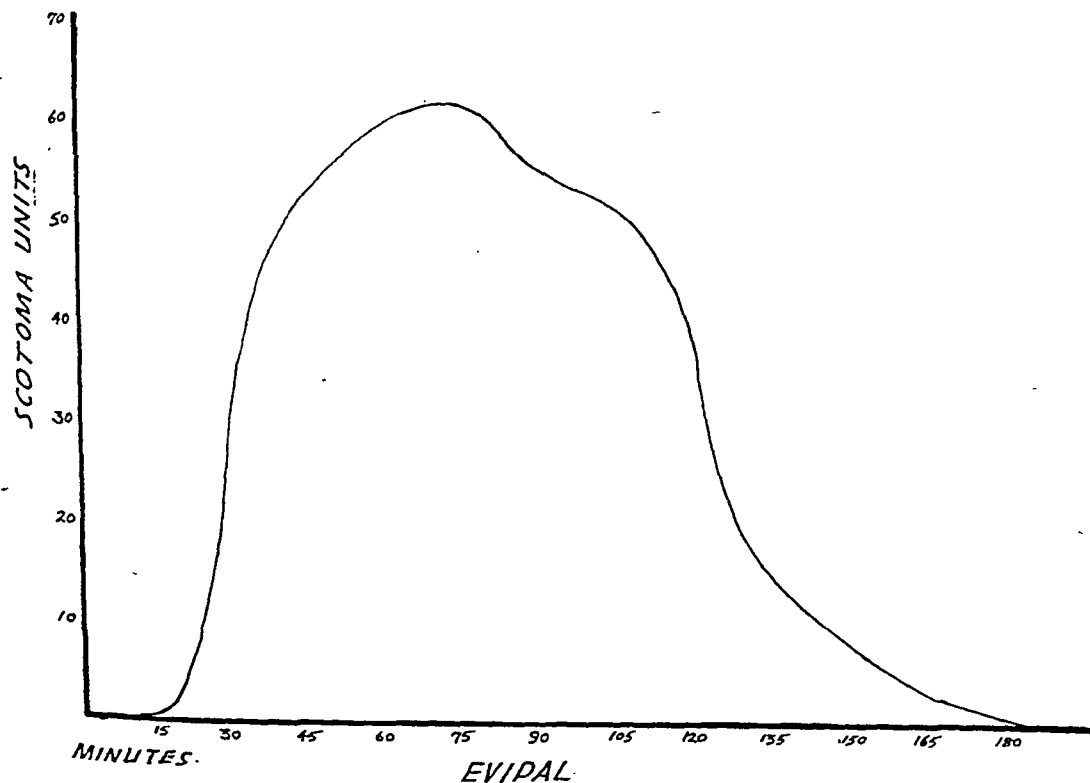


Fig. 3 (Fink). Graph illustrating the effect of evipal administration, expressed in scotoma units.

also exerts its influence to bring about the changes of the angioscotoma.

In summarizing, one might say that any one, or a combination of, the three pieces of evidence just presented might account for the alterations of the angioscotoma found in this experiment. Doubtless there are other mechanisms.

It will be remembered that 2 of the 10 subjects did not exhibit any change in the angioscotoma following the ingestion of evipal, whereas others showed a marked alteration of the central visual field. This seems in accordance with variations found in different patients when barbiturates are employed clinically. Some show no response; others are markedly depressed or even exhibit excitation.

On a controlled series of five of the subjects, an experiment was carried out, in which capsules containing 4 gr. of lactose (milk sugar) were administered orally. The subjects did not know that the capsules merely contained a placebo. The purpose of the control was to ascertain whether a psychologic factor was present and helped to cause the alterations in the angioscotomas occurring after the subjects ingested evipal. The method,

technique, and procedure employed were identical with those used for the evipal studies. The results demonstrated that, in the series of five subjects, no alteration of the angioscotoma was recognized.

CONCLUSIONS

Under the conditions of these experiments and in the subjects tested the following conclusions were drawn:

1. The oral administration of 4 gr. of evipal was associated with a widening of the angioscotoma in 8 of 10 subjects. The other two showed no recognizable change.

2. Administration of a placebo containing 4 gr. of lactose to five of the subjects of the evipal series produced no alteration of the angioscotoma.

3. One might ascribe the associated effect of evipal on the normal angioscotoma as related to changes in: (a) the perivascular space functions; (b) conductivity of the retinal neurons and synaptic junctions; and (c) the parasympathetic nervous system.

The author wishes to express his sincere appreciation to Dr. John N. Evans for his guidance and encouragement during the preparation of this paper.

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DISCUSSION

DR. FINK (closing): One thing that was revealed to me was the fact that evipal had any connection with the autonomic nervous system. At present, angioscoto-

metric studies are being carried out in our department on homatropine and atropine which should lend support to this observation.

THE ROLE OF LENS SUBSTANCE IN EXPERIMENTAL GONORRHEAL IRITIS*

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INTRODUCTION

In the course of studies^{1, 2, 3} on experimental gonorrheal iritis in rabbits, it was noted that the infection was more severe and more likely to become chronic in eyes in which the lenses had been traumatized at the time of inoculation. The present study was undertaken in an effort to explain this observation and to evaluate the role played by lens substance in the experimental infection.

Ophthalmologists have long known that in human eyes the degree of inflammatory reaction and the incidence of suppurative complications are greater after extracapsular extraction than after the intracapsular operation or any other "clean" intraocular procedure. However, there has not been general agreement as to the factors responsible for this. Discussion of the pertinent literature might be considered under three categories: (1) immunologic reactions with lens; (2) the toxic effects of lens substance; (3) the lens with relation to infection.

The study of immunologic reactions dates from Uhlenhuth's paper⁴ showing, by means of precipitin tests, that lens protein was organ specific. This has, in the main, been confirmed by others (Hektoen,⁵ Bellows⁶) and has also been demonstrated by anaphylactic reactions (Kodama,⁷ Markin and Kyes⁸). The classic

paper of Verhoeff and Lemoine⁹ on phacoanaphylactic endophthalmitis and the findings of the Johns Hopkins investigators have established it as an entity explaining some of the cases of postoperative inflammation.

The toxic effects of lens substance. Straub¹⁰ developed the concept of phacogenetic endophthalmia, that is, inflammation caused by the presence of lens substance in the ocular fluids. Gifford¹¹ and de Roeth^{12, 13} demonstrated that normal lens substance in the anterior chamber was irritative, that cataractous lens substance was even more toxic, and that nucleus was more toxic than cortex. Injection into the anterior chamber of some of the amino acids present in the lens gave rise to varying degrees of inflammatory reaction. Lens substance was digested by trypsin for a day and the resulting material injected into the anterior chamber. These one-day digests caused no inflammation; two-day digests caused mild iritis; four-day digests, severe iritis.

Braun^{14, 15} found that lens substance could bring about contraction of the isolated smooth muscle of the guinea-pig uterus and had a vasodepressor effect not attributed to histamine or acetylcholine. Orlov,¹⁶ by the injection of portions of cataractous lens into the anterior chamber of rabbits, confirmed the greater toxicity of nuclear as compared with cortical material.

The lens as a factor in facilitating infection. This was our major concern in the present investigation. Many of the

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standard treatises (Spaeth,¹⁷ Wiener and Alvis,¹⁸ von Blaskovics and Kreiker,¹⁹ de Schweinitz,²⁰ Meller,²¹ Norris and Oliver,²² Collins and Mayou,²³ and Clapp²⁴) make no mention of the relation between lens substance and infection. Czermak and Elschmig,²⁵ in discussing cataract surgery, advised the removal of the lens remnants and blood clots which form so suitable a medium for the multiplication of introduced bacteria.

De Wecker,²⁶ in 1883, commented on the greater likelihood of suppuration in operations where the lens capsule was incised than in noncapsulotomizing operations. He did not know why this was so, although he did not think that operative trauma played any important role.

Bacteria, in their effects on the intra-ocular tissues, were divided by Perles²⁷ into three large groups: (1) those that multiplied within the eye and caused inflammatory destruction of the organ—that is, panophthalmia; (2) those that did not persist within the eye but before their death caused noticeable inflammation; (3) those that caused no noticeable reaction. Bacteria of the second group, in larger numbers or with increased virulence, could cause panophthalmia; with a decrease in virulence, bacteria of the first group could cause self-limiting changes.

Chibret,²⁸ in 1888, found that *Staphylococcus aureus* was not able to survive *in vitro* either in water or in sugar solution, but did grow when lens substance was added. Leber²⁹ noted perforation of the lens capsule in experimental infection; he attributed this to the action of leucocytes rather than to bacteria or their products.

Andogsky,³⁰ in 1896, confirmed Chibret's findings and also inoculated the anterior chambers of rabbits with *Staphylococcus aureus* under various conditions. He found that anterior-chamber inocula-

tion of normal or of iridectomized eyes with small or moderate numbers of organisms resulted in a mild iridocyclitis; inoculation with large numbers of organisms resulted in perforation of the lens capsule and panophthalmia. However, inoculation of capsulotomized eyes with small numbers of organisms caused panophthalmia.

Hancock,³¹ in discussing the histopathology of postoperative infection, noted that the process was confined to the anterior segment and that considerable lens matter remained after extraction in the three enucleated bulbs he studied. He was of the opinion that a mild infection was present in most of the cases of severe reaction after extraction.

Treacher Collins³² demonstrated that lens capsule could heal in the lips of a corneal incision without causing inflammation. He also stated that aqueous humor containing lens substance was a good medium for bacterial growth. In the discussion, Elliot brought up the question of obstruction of the excretory channels by the viscid lens masses as an additional factor.

Lindner³³ called attention to the similarity of lens, skin, and mucous membrane as *epithelia*. He attributed to this the ease with which the pathogenic agents of epithelial tissue caused suppurative inflammation of the eye in the presence of free lens substance. Miklos³⁴ demonstrated that lens substance was, in general, a better medium for bacterial growth than was aqueous humor, meat extract, or blood serum.

In Velhagen's³⁵ case of purulent iridocyclitis, in which organisms considered to be gonococci were found in the eye, the lens capsule had ruptured and the organisms were particularly numerous in close proximity to the lens.

In the Lubarsch and Henke handbook, von Szily,³⁶ under the heading of septic

and experimental traumatic cataract, described in detail the histopathology of septic and aseptic wounds of the lens. Duke-Elder,³⁷ discussing purulent intraocular inflammations, called attention to the lens because of "the excellent culture medium which its substance provides for the growth of any type of organism."

To summarize the literature: In the first place, the lens has certain special immunologic properties; phacoanaphylactic endophthalmitis is a well-defined clinical and pathologic entity based on these properties. Secondly, the lens has some toxic effects; among its component parts, nucleus is more toxic than cortex, and cataractous nucleus is more toxic than non-cataractous. In the third place, there is abundant evidence that lens substance facilitates the multiplication of bacteria. It was toward a clarification of this latter problem with the gonococcus that our work was directed.

EXPERIMENTAL STUDIES

A. IN VIVO INOCULATIONS

Knowing that the lens was in itself toxic to some extent and also that it constituted a favorable medium for bacterial growth in general, we sought to determine what role these factors played in the development of experimental gonorrheal iritis. Several groups of experiments were performed. In one group, a suspension of gonococcus was inoculated into the anterior chamber of the rabbit. In a second group, sterile lens was injected; in a third, a mixture of gonococcus and lens. In a fourth group, gonococcus was inoculated, and the lens simultaneously injured with the hypodermic needle. As a control, in a fifth group, saline solution was injected and the lens injured.

The strain of gonococcus used was one isolated from a sulfathiazole-resistant

case of urethritis.* After three passages through the anterior chambers of rabbits' eyes, it was considered suitable for our purposes. Colonies were removed with a loop from the surface of the culture slant and were suspended in physiologic saline solution in a concentration of approximately 100 million organisms per c.c.

Lens substance was prepared in the following manner: The eye of a healthy young adult rabbit was enucleated, and the whole lens removed and placed in a test tube containing 5.0 c.c. of physiologic saline solution. The lens was broken up with a pipette, and the test tube shaken by hand for a few minutes. The resulting suspension had a turbid, opalescent appearance. It was bacteriologically sterile on culture and contained approximately 8 percent of lens substance as calculated from nitrogen determinations by the Kjeldahl method.

Gonococcus-lens mixture was prepared by breaking up a lens in a tube containing 5.0 c.c. of gonococcus suspension.

The volume of injected material was 0.2 c.c. The eyes were observed periodically, and careful descriptions were recorded. These were subsequently reduced, for purposes of tabulation, to symbols indicating the comparative severity of the intraocular reaction. After 8 to 14 days, the rabbits were killed, and cultures were made of the iris and lens.

Tables 1 to 5 summarize the appearance of the eyes and the results of autopsy cultures of the lens and iris. Zero (0) represents a normal eye. Plus-minus \pm signifies minimal exudation in the anterior chamber without grossly visible iridic hyperemia. One-plus (+) signifies

* The culture medium used throughout these studies was a casein-digest cystine agar.¹ For the recovery of gonococci from infected eyes, 10-percent fresh defibrinated rabbit blood was added.

TABLE 1
INFLAMMATORY REACTION IN EYES INOCULATED WITH GONOCOCCUS SUSPENSION.
LENSES UNINJURED. SERIES 1

Rabbit eye:	1L	2L	3L	4L	5L	6L	7L	8L
Days after inoculation:								
1	±	±	+	+	±	+	+	+
3	±	+	+	+	±	+	+	+
5	0	+	++	+	++	++	±	+
7	0	+	+	±	+	+	±	+
8	0	0	+	0	0	+	0	+
Post-mortem culture of lens and iris:	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.

The symbols in this and the following four tables represent the ocular inflammatory reaction as follows: 0=reaction absent; ±=reaction minimal; +=reaction slight; ++=reaction moderate; +++=reaction severe; ++++=reaction maximal.

a moderate amount of exudate in the anterior chamber and slight iridic hyperemia. Two-plus (++) signifies the presence of a small hypopyon, some corneal clouding, and moderate iridic hyperemia. Three-plus (+++) signifies a higher degree of corneal abnormality, a larger hypopyon, and intense iritic changes. Four-plus (++++) eyes generally show an almost opaque and greatly vascularized cornea, through whose more transparent central portions can be seen a hypopyon filling one third to one half of the anterior chamber.

Series 1. Gonococcus suspension was inoculated into eight eyes without injuring their lenses. Five of the eyes became normal in three to eight days; the other three showed one-plus reaction on the eighth day. The average reaction was a little less than one-plus. All post-mortem cultures were negative.

Series 2. Lens substance was injected into eight eyes without injuring their lenses. A maximal reaction of one-plus developed in one eye; the others showed zero to plus-minus reaction. By the fifth day all the eyes were normal. The first four eyes of this group were then used for Series 5.

Series 3. The gonococcus-lens mixture was inoculated into 24 eyes without injuring their lenses. Of the 20 eyes in which the ensuing process developed without complication, 16 had recovered clinically by the day the animals were killed, most of them by the seventh day; of the four eyes which did not, the reaction was one-plus in two, and two-plus and three-plus in one each on the day the animals were killed. The average reaction in these 20 uncomplicated eyes was closer to plus-minus than to one-plus. Of the four eyes in which complications devel-

TABLE 2
INFLAMMATORY REACTION IN EYES INJECTED WITH LENS SUBSTANCE. LENSES UNINJURED. SERIES 2

Rabbit eye:	17L	18L	19L	20L	21L	22L	23L	24L
Days after injection:								
1	±	±	0	±	±	±	±	+
3	±	0	0	0	0	0	0	+
5	0	0	0	0	0	0	0	0
7					0	0	0	0
9	Eyes 17L, 18L, 19L and 20L				0	0	0	0
11	were used for Series 5				0	0	0	0
14					0	0	0	0

TABLE 3

TABLE 3																								
INFLAMMATORY REACTION IN EYES INOCULATED WITH A MIXTURE OF GONOCOCCUS SUSPENSION AND LENS SUBSTANCE, LENSES UNINJURED. SERIES 3																								
Rabbit eye:	1R	2R	3R	4R	5R	6R	7R	8R	9R	10R	11R	12R	13R	14R	15R	16R	17R	18R	19R	20R	21R	22R	23R	24R
Days after inoculation:																								
1	±	+	+	+	+	+	±	+	+	+	+	+	±	±	+	+	±	±	±	+	+	±	±	+
3	0	0	+	±	±	+	0	0	+	+	+	0	0	+	+	+	±	±	0	+	+	0	0	+
5	0	0	+	0	0	+	0	0	+	+	+	0	0	+	+	+	0	0	0	+	+	0	0	+
7	0	0	+	0	0	+	0	0	+	+	+	0	0	+	+	+	0	0	0	±	+	0	0	+
8	0	0	+	0	0	+	0	0	+	+	+	0	0	+	+	+	0	0	0	±	+	0	0	+
11																								
14																								
Post-mortem cul- ture of lens and iris:	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Gram- neg. bac.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.

* 6R—Glaucoma, eye enlarged, A.C. deep.

** 9R—Glaucoma, eye enlarged, A.C. deep.

† 15R—Scleral rupture on first day after inoculation with Gram-negative bacillus as probable secondary invader.

‡ 16R—Glaucoma, eye not enlarged, A.C. deep.

oped, three became glaucomatous, with deep anterior chambers; in two of these, the glaucoma lasted long enough to cause enlargement of the bulbs; in the third, gross enlargement of the bulb did not develop. In the fourth eye of the group with complications, a rupture of the sclera occurred while it was being examined on the day after inoculation. Severe inflammatory reaction developed, and post-mortem culture revealed a gram-negative bacillus. Post-mortem cultures of the other 23 eyes were negative.

Series 4. Gonococcus suspension was inoculated into eight eyes with lens injury at the time of inoculation. These eyes showed, on the whole, a greater inflammatory reaction than those of any other series. When the animals were killed 11 days after inoculation, the reaction ranged from one- to four-plus in five of the eyes. The average reaction during the whole period was between two- and three-plus. The capsular rent in a sixth eye seemed to be healed on the third day, and the reaction had disappeared by the fifth day. The two remaining eyes became glaucomatous, the bulbs enlarging. One of these had an iris bombé; the other a deep anterior chamber. Of the eight eyes, two yielded a heavily positive culture of gonococcus from both the iris and lens.

Series 5. After they had recovered from the previous manipulation, physiologic saline solution was injected, with lens injury, into four eyes from Series 2. Three of the eyes became normal after four days, showing only one-plus reaction. The fourth eye showed persisting one- to two-plus reaction, and post-mortem culture revealed *Staphylococcus albus*. The other three eyes were sterile on culture.

TABLE 4
INFLAMMATORY REACTION IN EYES INOCULATED WITH GONOCOCCUS SUSPENSION.
LENSES INJURED. SERIES 4

Rabbit eye:	9L	10L	11L	12L	13L	14L	15L	16L
Days after inoculation:								
1	+	++	++	+++	++	++++	+	++++
3	+++	+++	++	+++	+++	++++	±	++++
5	+++	+++	++	+++	++	++++	0	+++
7	+++	++	++	+++	++	++++	0	+++
9	++++	++	+++	++	++	++++	0	++++
11	++++	++	++	++	+	++++	0	++++
						*	†	†
Post-mortem culture of lens and iris:	Many gonococci	Neg.	Neg.	Many gonococci	Neg.	Neg.	Neg.	Neg.

* 14L—Glaucoma, eye enlarged, A.C. deep.
† 15L—Capsular tear appeared healed by third day after inoculation.
† 16L—Glaucoma, eye enlarged, iris bombé.

TABLE 5
INFLAMMATORY REACTION IN EYES INJECTED WITH
PHYSIOLOGIC SALINE SOLUTION. LENSES
INJURED. SERIES 5

Rabbit eye:	17L	18L	19L	20L
Days after injection:				
2	+	+	+	+
4	+	±	0	0
6	++	0	0	0
9	+	0	0	0
Post-mortem culture of lens and iris:	Staph. albus	Neg.	Neg.	Neg.

The *in vivo* studies indicated that inoculation of gonococcus together with lens injury was necessary in order to effect a moderately severe inflammatory response. Inoculation, without lens injury, of gonococcus-lens mixture or of gonococcus

alone produced only a mild inflammation. Injection of lens substance or aseptic injury to the lens caused a minimal reaction.

B. IN VITRO STUDIES

In the preceding experiments, about four hours had been required to complete the inoculations. The substances used for inoculation were then cultured to rule out the possibility of bacterial contamination. The cultures indicated that more gonococci had remained viable in the suspension which contained lens than in the one which did not (fig. 1). Studies were accordingly undertaken to determine whether lens substance was able to prolong the life of gonococci in suspension.

Gonococci which had been grown over-

TABLE 6
VIABILITY OF GONOCOCCI IN THE PRESENCE OF RABBIT LENS

Time:	0	4 hours		1 day		2 days	3 days	4 days	5 days	6 days	7 days	8 days	9 days
Dilution:	1:100	1:100	1:10	1:100	1:1	1:10	1:10	1:10	1:10	1:10	1:10	1:10	1:10
Gonococcus (control)	++++	neg.	+++		neg.								
Gonococcus plus fresh lens	++++	++++		++++		++	+	neg. (contaminated)					
Gonococcus plus autolyzed lens	++++	++++		++++		++++	++++	++++	+++	++	+++	+++	neg.

A capillary drop (approximately 0.02 c.c.) was spread out on a culture plate, incubated at 37°C. in a candle jar for 48 hours, and the plates then examined. The following symbols denote the results: neg. = no growth; + = less than 50 colonies of gonococci; ++ = 50-99 colonies; +++ = 100-299 colonies; ++++ = 300-599 colonies; or confluent growth.

night on the surface of a culture slant were suspended in Ringer's solution in a concentration of approximately 100 million microorganisms per c.c. and divided into 3 tubes of 5 c.c. each. One tube served as the control; to the second was added a fresh, macerated rabbit lens; to the third, a rabbit lens which had been macerated and allowed to autolyze in

appreciable change occurred at one day; at two and three days progressively fewer gonococci were viable; at four days, they could no longer be demonstrated on culture. In the third tube, containing gonococci and autolyzed lens, viable organisms persisted for eight days. The cultures were strongly positive for four days and only then began to yield fewer gonococci.

GONOCOCCI
PLUS
LENS

GONOCOCCI
ALONE



LENS ALONE

Fig. 1 (Drell, Bohnhoff, and Miller). Culture plate showing greater survival of gonococci in the presence of lens substance than in saline suspension alone. Results of culture of the inoculating materials used in Series 1 to 4.

Ringer's solution for 48 hours at 4°C. The number of living gonococci was estimated by culturing serial 10-fold dilutions of each of the tubes. The suspensions were kept at 37°C. and cultures were repeated after 4 hours and 24 hours, and daily thereafter for 9 days.

The results are summarized in table 6. In the control tube, containing no lens, fewer gonococci were viable at four hours and none at one day. In the second tube, containing gonococci and fresh lens, no

A similar experiment was performed in which a fresh human lens was used. This was a simple senile cataract that had been extracted intracapsularly. The results are summarized in table 7. They were similar to those obtained with fresh rabbit lens. The control tube yielded negative cultures at one day, whereas the tube containing gonococci and lens showed a slight decrease at 24 hours, fewer organisms at two and three days, and none at four days.

Using a variety of solid and liquid media to which both fresh and autolyzed lenses had been added, attempts were made to obtain evidence of *in vitro* multiplication of the gonococcus in the presence of lens, as had been done by Miklos⁵⁴ with other microorganisms. These studies yielded negative results.

COMMENT

The gonococcus was recovered on culture only from that group of eyes (Series 4) in which the lenses had been injured

coccus aureus caused panophthalmia. We found that similar inoculation with gonococcus caused only a moderately severe anterior uveitis. The difference is probably due to the less potent pyogenic properties and the more selective cultural requirements of the latter organism.

As a pyogenic agent, the gonococcus occupies a position between groups 1 and 2 of Perles's classification of bacteria in relation to the eye. Ordinarily, a short-term infection results, the microorganism dies, and recovery occurs. Occasionally,

TABLE 7

VIABILITY OF GONOCOCCI IN THE PRESENCE OF CATARACTOUS HUMAN LENS

Time	0		1 day				2 days	3 days	4 days
Dilution:	1:1000	1:100	1:1000	1:100	1:10	1:1	1:10	1:10	1:10
Gonococcus (control)	++++	++++				neg.			
Gonococcus plus lens	++++	++++	+	+++	++++		++	+	neg.

Technique and symbols as in table 6.

at the time of inoculation. Two of the eight eyes in this group yielded positive cultures. In a comparable group of eyes previously studied with the same strain,² the presence of gonococcus was demonstrated in 10 of 12 eyes either on culture or histologic examination. The organism used in the earlier studies had been passed through more than 40 rabbit eyes; it then seemed to be more virulent for the rabbit eye than in the initial stages of animal passage. It should also be pointed out that, in the meantime, the organism had been maintained on artificial media for over a year before the present study was initiated. Since these experiments were designed to compare the effects of gonococci injected under various conditions, three animal passages before use were sufficient.

Andogsky found that injury to the lens at the time of inoculation with *Staphylo-*

however, the gonococcus may be present in great numbers; or it may be so virulent as to cause disruption of the lens capsule (as in Velhagen's case); or post-operatively, sufficient lens substance may be present in the aqueous. Conditions then become favorable, and a severe infection results.

The rapid death of the gonococcus in the eye under ordinary circumstances, with the liberation of its irritative endotoxin, explains the self-limiting and acute nature of ordinary gonorrheal iritis. No allergy nor general toxemia need be postulated. The endotoxin is a poor stimulant of antibody production; this is probably why immunity is so slight and recurrences are so common.

In contrast with most other bacteria, the gonococcus is a fastidious microorganism, requiring certain specific conditions for its survival and multiplication.

Our *in vitro* studies indicated that lens, particularly after autolysis, greatly prolonged the organism's survival time. It has been demonstrated by Morax³⁸ that the survival of the gonococcus without multiplication varies with the individual strain and is in the order of three to nine days. We were unable to demonstrate any multiplication in our *in vitro* studies. McLeod, Wheatley, and Phelon³⁹ have demonstrated with some of the amino acids a favoring or inhibiting action on growth of the gonococcus. Further studies along this line would be of interest.

SUMMARY

The inoculation of gonococcus into the anterior chamber of the rabbit with lens

injury resulted in a moderately severe and chronic inflammation.

The inoculation of gonococcus without lens injury caused a mild inflammatory reaction. Inoculation of gonococcus-lens mixture without lens injury usually caused a similar reaction.

The injection of lens substance without lens injury or the injection of physiologic saline solution with lens injury caused only an insignificant inflammatory response.

Lens substance *in vitro*, particularly after autolysis, prolonged the survival time of gonococci. No clear evidence of multiplication was obtained under these conditions.

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DISCUSSION

DR. S. JUDD BEACH (Portland, Maine): Dr. James H. Allen asks: "What was the time interval between injection of lens substance in Series 5 and the second inoculation of some of those eyes with injury of the lens in Series 5?"

DR. M. J. DRELL (Seattle, Washington): Five days, by which time the reaction from the injection of lens substance

had cleared completely.

DR. BEACH: Dr. M. J. Hogan asks: "Do you think lens substance exerts merely a protective effect on the organisms rather than acting as a culture medium?"

DR. DRELL: That question bothered us for a long time. Dr. Miller has been working with the gonococcus for many years, and the project originally was commenced

at the request of the O. S. R. D., in an effort to produce an experimental infection against which the sulfonamides and other therapeutic agents could be assayed. The gonococcus theoretically ought to grow in the presence of lens. We tried to make it grow but were unable to obtain any clear-cut evidence of its growth. We do know that lens substance is an excellent buffer; the suspension in which lens was present varied only slightly from pH 7.4 to pH 7.2 over a period of five days, whereas the pH of gonococcus suspension alone, in saline or in Ringer's, became acid, dropping from 7.4 to 6.8. This is probably one of the necessary factors. However, the lens also contains a great many of the nutritive agents on which the gonococcus should be able to live and multiply, and we were unable to demonstrate any multiplication.

The survival time of the individual gonococcus has been estimated by Morax to be between three and nine days, varying with the strain. The survival time of gonococcus in our study was eight days. Whether there was any multiplication of any sort during this period we are unable to say positively.

DR. TAUB: Dr. Kinsey wishes to know: "Were culture media tried containing glutathione or other sulfahydrides?"

DR. DRELL: The culture medium used was casein-digest cystine agar prepared in

the laboratory. It contained 0.065 percent of cystine, which I do believe is a sulfahydride.

DR. V. EVERETT KINSEY (Boston): Cystine or Cystein?

DR. DRELL: Cystine. This medium was used for the recovery of the organisms from infected eyes. Lens itself contains cystine, which is one of the reasons we thought that the gonococcus would be able to grow upon it.

DR. WALTER B. LANCASTER, chairman, (Boston): Will the essayist tell us whether injury to the lens or other optical injury occurs if the gonococci are introduced intravenously or somewhere outside the eye?

DR. DRELL: I presume the question refers to work similar to that reported by Dr. Rosenau with streptococci. I cannot recall any such investigations with gonococci with any positive results.

Perhaps another word should be added here. The attempt to produce the gonorrheal iritis is nothing new. It has been tried almost since the time that the organism was first described. The organism apparently needs to have its virulence enhanced in some way. The strain used by us was initially enhanced by something like 134 passages through the mouse peritoneum before it was sufficiently virulent for the purposes of producing this iritis.

SPONTANEOUS RUPTURE OF THE LENS CAPSULE IN ANTERIOR LENTICONUS*

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Spontaneous rupture of the lenticular capsule has been reported as occurring in eight patients to date, in seven instances in association with senile cataracts, some of which had advanced to a morgagnian stage.

Apparently the first mention of this condition was by von Szily,¹ who, in 1884, reported a case of spontaneous rupture of the capsule and, at the same time, mentioned two similar cases by von Ulrich and von Arlt. Some 30 years later, in 1913, Rollet and Genet² published a case that occurred in a man, aged 67 years, whose left eye had undergone a successful cataract extraction approximately 12 years previously. The right eye, in which there was a milky (*laiteuse*) cataract, suddenly developed severe pain. Examination revealed a white fluid in the anterior chamber and increased ocular tension. The authors assumed that there had been a rupture of the capsule of the lens.

Gonzales,³ in 1919, described a woman, aged 75 years, in whose left eye he had noticed a mature cataract 14 years earlier. This eye became painful and, at examination, the anterior chamber was seen to be completely filled with a milky-white liquid. The pressure was much higher than normal.

Kaufman,⁴ in 1933, described the case of a man, 58 years old, who had been told 12 years before that he had a cataractous lens in his left eye. When seen, there was a three-day history of pain and redness of that eye. The upper eyelid was swollen. The anterior chamber was filled with a milky-white fluid which hid the details of the iris. Under slitlamp magnifica-

tion, cholesterol crystals could be seen in this fluid. The intraocular pressure measured 62 mm. Hg (Gradle-Schiøtz).

In 1937, Knapp⁵ reported the case of a woman, aged 67 years, with a blind eye, the condition of which had, at one time, been diagnosed as inactive choroiditis. Later, but 23 years prior to the rupture, a mature cataract was noted. Three months before Knapp's examination, one of the patient's relatives noticed an increase in the size of the white spot in the pupil. When seen, there was a mild pericorneal injection and a regularly dilated pupil which was filled with a white mass extending into the anterior chamber. The tension was recorded as 42 mm. Hg (Schiøtz).

The most recent case was reported by Box⁶ in 1941. His patient was the youngest to be reported with this condition. Since the age of 18 years, he was known to have opacities of both lenses which were thought to be congenital; their extent was not described. At the age of 34 years, an immature cataract reduced the vision of the left eye to perception of hand movements, with good light projection. About two years later, the patient returned with a history of improved vision in the left eye and deterioration of vision in the right. An iridocyclitis which the author regarded as of tuberculous origin was found in the right eye. The left eye appeared aphakic despite the absence of a history of trauma or surgery. X-ray examination showed no evidence of a foreign body. No corneal scar could be seen. Examination under the slitlamp revealed a temporal gap in the anterior lens capsule and some soft lens matter still present. After a needling op-

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eration was performed for the latter condition, corrected vision ultimately was 6/6 partly.

For completeness, another case may be added to this list. However, the element of trauma makes its inclusion in this series controversial. Beisbarth⁷ performed an iridectomy for secondary glaucoma on the eye of a woman, aged 65 years. Tension fluctuated between 25 and 37 mm. Hg (Schiotz), and there was an increased cloudiness of the lens. The eye seemed to tolerate the operation but five weeks later it became painful and, during the night, the patient experienced excruciating pain. In the morning, she said something had come out of the eye and brought to the ophthalmologist, as proof, a lens nucleus on a piece of gauze. Examination showed a small round hole at the limbus through which a tag of capsule appeared.

ANTERIOR LENTICONUS

Cases of anterior lenticonus are more frequent than rupture of the lens capsule. Only the literature on this subject that has appeared since the publication in 1934 of the paper by Rones⁸ will be mentioned here. He listed 10 recorded cases in which the diagnosis of anterior lenticonus appeared justified. In addition, he mentioned several other cases which he considered incorrectly diagnosed as lenticonus. Since then, a search has revealed 10 additional cases.

In 1936, Moulton⁹ described the case of a man, aged 33 years, who had bilateral lenticonus. Biomicroscopic examination showed that in each eye the anterior band of the lens and the anterior band of disjunction curved forward over the clear underlying contents of the conus. There was no alteration in their parallelism nor change in their thickness. The nucleus and posterior cortex of each lens were normal. A very few minute, delicate opacities were visible on the apex of the

cones and just beneath the intact anterior capsules.

Rauh,¹⁰ in 1936, reported the case of a man, aged 48 years, who had a lenticonus of each eye in which only the zone between the adult nucleus and the capsule bulged forward. The nucleus itself appeared normal in contour in each eye.

Knobloch¹¹ described, in 1937, anterior lenticonus developing in both eyes of a motion-picture operator, aged 20 years. According to an abstract, which was the only report available to the author, slit-lamp examination showed arching of the anterior capsule only, but not the limits of the surface between the detached zone and the cortical zone.

In 1939, Zavalia and Oliva¹² described the cases of two brothers, aged 23 and 15 years, in whom uncomplicated anterior lenticonus developed at puberty. The parents were cousins. This consanguinity and the presence of lenticonus in the siblings emphasized the role of heredity in this report, although apparently it played no obvious part in any of the cases described elsewhere. The older brother had lenticonus in both eyes. The condition was unilateral in the younger brother, but the fellow eye had an anterior-central capsular cataract. The illustration of the lenticonus in the younger patient showed an asymmetry in the protrusion of the anterior capsule and its underlying cortex which was not present in the regular curve of his brother's lenticonus. In this latter patient, there was seen a concavity in the usual convex surface of the anterior band of the adult nucleus corresponding to the lenticonus.

Ter-Artuniantz, Kotilianskaja, and Chutko¹³ reported, in 1939, two cases with all the symptoms of posterior lenticonus, but subsequently biomicroscopy demonstrated that one of these was a case of anterior lenticonus.

In 1940, Harris¹⁴ described the case of

a man who, for as long as he could recall, had had poor vision and was forced to leave school at the age of 16 because his sight suddenly and rapidly deteriorated. Slitlamp examination showed, in each eye, a globular protrusion of the anterior cortex and capsule through the pupil to within 0.5 mm. of the cornea. The anterior cortex and the capsule of each lens alone were implicated in the lenticonus. The nuclei were of normal configuration. However, just behind the center of the nucleus, were discoid punctate cataracts which were round and finely granular.

In 1942, Damel and Garbarino¹⁵ reported the case of a man, aged 24 years, whose vision had become poor when he was 15. He had bilateral lenticonus. The lens capsule and the anterior cortex presented the usual forward bulge, with a normal underlying nucleus.

Rocha and Coscarelli¹⁶ described, in 1943, a 30-year-old woman with bilateral lenticonus, the base of each cone being about 3 to 4 mm. in diameter. There were a few opacities of the coronary type, as well as some filaments of persistent pupillary membranes between the lens and the iris.

Marback¹⁷ published the most recent report in 1943. His case, occurring in a man aged 23 years, was one of microphakia with a lenticonus on the anterior face of each lens. The deformity involved the anterior capsule and the anterior half of the senile nucleus, the fetal nucleus appearing normal. The condition of the cortex was not described.

CASE REPORT

L. S., a boy, aged 12 years, was first seen on May 20, 1944, with a history of having worn spectacles for two years. He first realized that he had a defect of vision three years before, when his right eye became red after a mild blow received during a fist fight with another youngster. There was a history of nephri-

tis, hay fever, and asthma. Urinalysis showed the presence of albumin 2+, red blood cells, and casts. There was no edema. The blood pressure was 120/70.

Vision of the right eye was 4/200 and could not be improved. Retinoscopy revealed the characteristic appearance of a droplet of oil in the retinal reflex. The external and ophthalmoscopic examination presented no abnormalities. On examination with the slitlamp, there was seen a bulging forward of the anterior capsule in the axial region. The diameter of the bulge appeared to be 2.5 mm., and the elevation possibly one fourth the depth of the anterior chamber. This elevation seemed filled with a clear liquid which separated the anterior capsule from the lens substance. There was a very small amount of pigment on the capsule at the base of the elevated area (fig. 1).

The left eye appeared normal on external, ophthalmoscopic, and slitlamp examination. The reflex on retinoscopy was normal. There were 2.25 diopters of hypermetropia. Corrected vision was 20/20.

The patient was next seen a month later. At this time, the father said he had noticed, about a week and half previously, that there was a white substance in the pupillary region of the right eye. There had been no previous injury of any kind to either the eye or the head. Visual acuity was found to be reduced to the perception of hand movements. Soft lens material obviously protruded into the anterior chamber. Under the slitlamp, a tear could be discerned in the anterior lens capsule at the summit of the elevation. Swollen cortex presented through the tear into the anterior chamber (fig. 2). The intraocular pressure in each eye was 15 mm. Hg (Schiötz). Atropine was prescribed. It was decided to keep the eye under observation.

When seen three weeks later, the boy said that he had struck the right eye two days before. At this examination some of

the lens material was observed to have broken loose from the main mass, which was now larger than before, and was present in the lower part of the anterior chamber, descending almost to the angle. A few weeks later this separated lens substance had become absorbed. The area of opacification extended beyond the limits of the elevation of the capsule and spread about halfway to the equator of the lens. By November, the lens was almost entirely cataractous. An exotropia of about 20° was present. On January 26, 1945, a linear extraction of the cataract was performed, and the greater part of the lens washed out. Because of persistent pro-

trusion, could be made out under the slitlamp. After a year of progress, this gray area on the lens capsule showed con-



Fig. 3 (Ehrlich). External appearance a year later.



Figs. 1, 2 (Ehrlich). Slitlamp appearance of eye with anterior lenticonus. Fig. 1. Showing pigment at base of elevation. Fig. 2. Ruptured capsule.

trusion of the iris, a narrow iridectomy was made. A month later, vision of the right eye was 20/20 with a $+12D.$ sph. $\ominus +1D.$ cyl. ax. 180° .

While all this was taking place, changes began to be evident in the left eye. In September, 1944, a minute dot was seen in the anterior capsule. In the course of three months, two dots with a connecting line between, in a sort of dumbbell ar-

range enlargement and seemed to have the form of a horseshoe (fig. 3).

DISCUSSION

Spontaneous rupture of the lens capsule obviously will take place when the volume of the lens is greater than can be contained within the elastic capsule which, however, may stretch in compensation. Modifying factors will be: (1) Rapidity of the swelling; (2) variations of capsular tensile and elastic factors; (3) location of the swelling when not diffuse but confined to a portion of the lens.

That there is elasticity of the lens capsule to permit swelling was observed by Bowman¹⁸ who stated: "When removed from the eye and placed in water, the lens imbibes fluid through its capsule, which thereby becomes distended and separated from the contained lens, being raised in the form of a vesicle." Limitations naturally exist as to the amount of capsular stretching that can take place under such conditions, as has been shown by Bellows

and Chinn,¹⁹ who reported the spontaneous bursting of some lenses by swelling when subjected to various chemical solutions and altered physical conditions. One would assume that slow swelling, taking place over long intervals, would permit of greater volume without rupture of the lens capsule. This, however, can only be surmised. It is obvious that there is some limit to the extent of capsular enlargement.

The capsule increases in thickness with age. Whether this adds to or diminishes its tensile capacity cannot be stated. It is, perhaps, related to the diminution of its permeability with age as Friedenwald²⁰ has demonstrated.

Another theoretical consideration revolves about the possibility of the capsule sliding over the surface of the lens. If a small, localized elevation occurs anywhere on the lens surface, the overlying capsule will be subject to less strain if the entire capsule, or at least a large portion of it, shifts its position toward the region of the swelling. Otherwise, it is the portion of capsule immediately overlying the swelling that must bear the entire burden of adaptation to the new conditions, with a consequent increase in the possibility of rupture. When liquefaction of the lens substance occurs, increased pressure is distributed uniformly throughout the lens.

Alteration in the strength of the capsule undoubtedly occurs in the pathologic condition represented by morgagnian cataract. Duke-Elder²¹ apparently attributes to this factor the known cases of spontaneous rupture herein listed as well as the hypothecated ones wherein rupture is considered as being the possible explanation for some of the reported cases of spontaneous absorption of a morgagnian cataract, stating that they may be due to a rupture "in the thin capsular wall." Kaufman⁴ also has observed that the wall of the capsule is always thin in these cases. Under these conditions of

weakening of the capsule, a sudden increase in the intralenticular pressure or an alteration in relationship between the intralenticular and intraocular pressures could easily be the immediate and exciting factor in the rupture of the lens capsule. Ordinary daily activities and stresses or a sudden imbibition of fluid resulting from altered osmotic pressure relationships (possibly a result of disintegration of the lens protein) could increase or alter these pressures.

Senile and morgagnian cataract need not be the only varieties to provide the conditions for spontaneous rupture. Box's⁶ case occurred in the eye of a 36-year-old man, although it is possible that the morgagnian type of disintegration of the lens substance took place in the 27-month interval between the time when he was observed to have an immature cataract and when he returned manifesting a gap in the capsule of the partly absorbed lens.

Another case, more closely resembling the one here reported, is that of Feigenbaum.²² The patient was an Arabian youth with bilateral anterior lenticonus who, over a period of three years, had shown an increase in the lenticonus. When seen again, after another three-year interval, the right eye was essentially unchanged. Retinoscopy, however, revealed only a slight myopic astigmatism of the left eye in place of the 9 diopters of myopia previously present in the central portion of the lens. At this time, the patient said he had noticed a corresponding improvement in his vision. Biomicroscopy showed the protrusion to have been replaced by a somewhat dense subcapsular opacity at the same spot and of about the same size as the former lenticonus. Feigenbaum concluded that the increase in the convexity at the anterior pole "caused the capsule to burst in one place, resulting in a localized opacity, which means that a self-healing of the lenticonus

took place." Such a change from anterior lenticonus to anterior capsular cataract has also been described by Jaworski²³ and Tsukahara,²⁴ and both were attributed to a similar pathogenesis by Feigenbaum.

Jaworski's case was that of a 32-year-old man who had a bilateral lenticonus. When seen eight months later, there was present in the right lens a 2-mm. opacity in place of the lenticonus. In the left lens, there was a similar opacity, but a small amount of protrusion could still be made out. Unfortunately, this case was reported in the days before the slitlamp came into use, and so small capsular ruptures could easily be overlooked.

Rones⁸ believed that Tsukahara's second case does not properly belong with those called lenticonus, but it may well have been because the original article was published in Japanese, and the abstract in German does not give sufficient details to eliminate it definitively from this category. Tsukahara's first case obviously should not be included. His second case was of a 17-year-old boy with a unilateral lenticonus. Eight months later an anterior capsular cataract was added to this lenticonus. At this time the previously normal lens of the left eye also had an anterior capsular cataract. It is difficult to understand, on the basis of this meager information, how Feigenbaum can postulate a rupture in the lens capsule.

Review of the reported cases reveals two significant features: In every instance both eyes were sooner or later involved. This, in most instances, took the form of lenticonus in each eye. The exceptions are the younger of Zavalia and Oliva's two brothers, who had an anterior capsular cataract in one eye and lentiglobus in the other; the case of Tsukahara just described; and Feigenbaum's case after the disappearance of the lenticonus in the left eye.

The other feature is that the pathologic

process in almost every case involved the anterior capsule and cortex only. Of course, cases reported prior to biomicroscopy cannot be included. Exceptions to the localization of the pathologic process were: (1) the older of the two brothers described by Zavalia and Oliva who had a concavity in the normal uniform convex curve of the anterior band of the adult nucleus. (2) Harris's¹⁴ case presented, in addition to the lenticonus which involved only the anterior capsule and cortex, discoid punctate cataracts just behind the center of the nucleus. (3) Marback¹⁷ states that the deformity in his patient lay in the anterior capsule and the anterior half of the senile nucleus, the fetal nucleus being normal.

Ter-Artuniantz, Kotilianskaja, and Chutko's case¹³ is not included in the generalizations just made regarding bilaterality and the lack of nuclear involvement because the original article was not available and the abstract did not describe these features.

Any theory as to the origin of anterior lenticonus must account for the normal appearance of the nucleus. It is difficult to comprehend how a congenital disturbance would permit the nucleus to develop normally and make its effect felt only after puberty. The bilaterality of the lesion and the lack of a hereditary tendency (only Zavalia and Oliva's brothers present such a factor) would point to a metabolic disturbance. The nephritis of the patients of Kienecker²⁵ and Jaworski²³ and the two constitutional elements of allergy and nephritis in the case here reported give some support to such an element in the causation of anterior lenticonus. In their articles, Rones⁸ and Bellows²⁶ both discuss the various theories of the causation of anterior lenticonus, which need not be repeated in this report.

Although the accuracy of the diagnosis of anterior lenticonus in the case herein described may well be questioned, there

seems to be no other described condition that corresponds to it more closely. Vogt's atlas,²⁷ as well as the smaller one of Meesmann,²⁸ illustrates no similar case, nor is one included in Bellow's recent encyclopedic work on cataract and lenticular anomalies.²⁹ The process in the right eye seems similar to the one Feigenbaum²² described as occurring in the left eye of his patient except that the rupture in the latter case must have been much smaller. If the anterior capsular change of the lens of the left eye which developed during the period of observation had been present when the patient was first seen, it would have appeared essentially the same as that of the younger of Zavalía and Oliva's patients. In Tsukahara's case, the anterior capsular cataract also developed during observation. The spontaneous improvement in both eyes of Jaworski's patient, within an interval of only eight months, indicates the

rapidity with which such a change may occur. Our patient was seen only by chance in the interval between the breakdown and liquefaction of the lens substance in the lenticonus, when rupture of the extended and strained capsule was imminent and before the actual rupture of the membrane took place.

SUMMARY

A case of anterior lenticonus in a boy is described. It is unusual in that it was unilateral; that the cone contained liquefied lens material; and that it ruptured spontaneously. During the period of observation, the left eye developed central-anterior capsular changes.

The literature on spontaneous rupture of the lens capsule and on anterior lenticonus has been summarized and discussed in relation to the case here reported.

211 Central Park West (24).

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CONTUSION CATARACT OF THE ANTERIOR LENS CAPSULE*

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CASE REPORT

The traumatic cataract described by Vossius¹ is thought to originate from the deposit of uveal or blood^{2, 3} pigment upon the anterior lens capsule at the pupillary margin when the iris is forced against the lens by contusion of the globe. A recent case of perforating injury of the eye presented a cataract of similar etiology. This cataract involved the anterior lens capsule only. A perfect, although very faint, imprint of the circular sphincter pupillae muscle fibers and of the radial markings of the iris was stamped upon the anterior lens capsule. It contained no pigment, and was a much more complete reproduction of the iris anatomy than the pigmented ring or arc which marks the site of the pupillary margin upon the anterior lens capsule in cases of Vossius-ring cataract. This lenticular opacity appears to be a unique variety of traumatic cataract not yet reported in the ophthalmic literature.

History. D. M. D., an aviation machinist mate, aged 20 years, was examined on August 2, 1945, to determine his fitness for sea duty. His medical record confirmed a remarkable history of trauma to his right eye. On December 3, 1944, while he was engaged in cleaning a metal lathe with a medium-pressure air line (50 lb.), he was struck in his right eye by a blast of air when, for a moment, he lost control of the hose. Two days later he reported to his sick bay, complaining of pain and redness of his right eye. Corneal ulceration was noted at the 8-o'clock position, with cloudiness of the cornea below. Ophthalmoscopy revealed a triangular, metallic foreign body lying within the vitreous in the lower temporal aspect of the fundus. Roentgen examination showed two metallic foreign bodies, in the lateral view, in line with the orbits. These were not visualized in the posterior-anterior view.

* From United States Naval Hospital, Astoria, Oregon. The opinions or assertions contained herein are the private ones of the writer and are not to be construed as official or reflecting the views of the Navy Department or the Naval Service.

At the United States Naval Hospital, in Oakland, California, it was noted that the patient had a healed, perforating wound of the cornea at the 9-o'clock position. Beneath this wound, the iris was

punctured, and there was a visible track through the lens. Six disc diameters along the inferior temporal vessels, a shiny foreign body, measuring one disc diameter in length and one-fifth disc diameter in width, was visible upon ophthalmoscopy and appeared to be located 1 mm. from the retina. Roentgen studies failed to show any foreign body in or near the right eye. Conservative treatment, consisting of the instillation of atropine and application of heat locally, was followed. By January 2, 1945, the right eye was free of pain and all visible signs of inflammation. After 30 days, there having been no appreciable change in the condition of the right eye, the patient was returned to duty.

Examination. When this patient was examined in August, 1945, bilateral vision was 20/15. The left eye, upon external examination, palpation of the intraocular pressure, and ophthalmoscopy, was entirely normal. The right eye showed a penetrating scar of the cornea located at the 9-o'clock position, 2.0 mm. within the limbus. It was 0.5 mm. in width and 2.0 mm. in length, being directed obliquely upward toward the corneal vertex. Slightly above the corneal wound and just within the limbus, there was a faintly atrophic scar of the iris which measured 1.0 mm. in width and extended vertically 2.0 mm. No track could be located within the lens. The ocular tension to palpation was normal. By focal illumination and by biomicroscopic examination with diffuse direct illumination, a complete reproduction of the circular sphincter pupillae muscle fibers and of the radial pattern of the iris was observed to have been laid down upon the anterior lens capsule, in faint, grayish-white markings. These markings were confined to the lens capsule and contained no pigment. The biomicroscope showed no other lenticular pathologic

change, but revealed a finely granular disorganization of the vitreous in the zone immediately behind the lens. Ophthalmoscopy showed no pathologic lesion in the ocular media other than the corneal scar. The cataractous changes of the anterior lens capsule and the vitreous disorganization were invisible. The fundus was essentially normal, although its lower temporal region showed very slight disturbance of the retinal pigment. No trace could be found of the previously reported metallic foreign body.

Roentgen report. The Hospital roentgenologist made the following report: "There are two minute, opaque foreign bodies in the region of the right orbit. The first measures approximately $1.0 \times 1.0 \times 0.25$ mm. It is extraocular in location. The second measures approximately $1.0 \times 0.5 \times 0.25$ mm. It lies 11.5 mm. below the horizontal plane of the cornea, 4 mm. to the temporal side of the vertical plane of the cornea, and 13 mm. behind the center of the cornea; therefore, it lies in or close to the sclera."

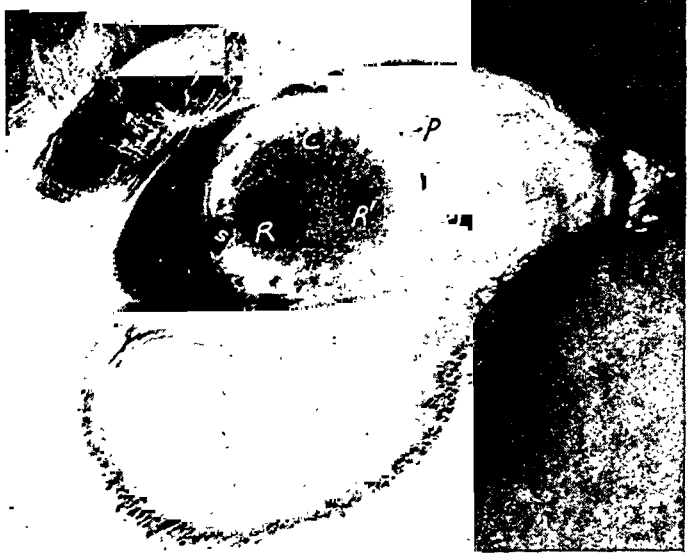
DISCUSSION

This case has several features of unusual interest. It would appear that the retained metallic foreign body was either completely absorbed or that it was extruded from the eye by migration through the sclera. The absorption of foreign particles within the eye (for copper) was first reported by Leber⁴ in 1892. Fifty years earlier Castelnau⁵ had reported the migration of intraocular foreign bodies through the sclera. Extrusion of such a particle, according to Cordes and Harrington,⁶ is accompanied by ocular inflammation with softening of the sclera. Since, in this case, all inflammatory reaction had subsided within the 30th day after the accident, the foreign body remaining visible to ophthalmoscopic examination all the while, it would appear that transcleral migration

had not occurred. However, after the accident, two metallic foreign particles were visualized by X-ray examination. Again, when this patient presented himself for examination for fitness for sea duty, seven months later, two metallic foreign

gory of traumatic cataract not previously described. Impact of the iris against the lens, due to the application of tremendous force to the eyeball, has effected permanent alteration of the tissue of the anterior lens capsule. This alteration of

Fig. 1 (Sudranski). Photograph of the right eye, made under intense focal illumination (directed from the temporal side) with the pupil widely dilated, showing the pupillary margin at P, the corneal limbus at L, and the folded iris tissue at I. S marks the site of the scar near the corneal limbus temporally and directed toward the corneal vertex. The large, bright reflex from the anterior surface of the cornea is at R. The smaller, fainter reflex from the anterior surface of the lens is at R'. The latter is seen at the same level as the cataractous markings of the anterior lens capsule, C. The far periphery of the lens appears entirely black, indicating that the anterior lens capsule is uninvolved where the lens surface, near its equator, curves sharply away from the plane of the iris. (Official U. S. Navy photograph.)



bodies (one of which was localized in or close to the sclera) were still demonstrable by the X ray. Two observations would appear to afford sufficient evidence that, in this case, the intraocular metallic foreign particle may have been actually extruded from the eyeball by transcleral migration; namely, (1) the foreign bodies roentgenographically visible were not reduced in number (even though the one at first observed within the vitreous had later disappeared), and (2) the slight disturbance of the retinal pigment in the lower temporal portion of the fundus.

Even more remarkable is the presence of grayish-white opacities of the anterior lens capsule so arranged as to reproduce, in detail, the anatomic markings of the posterior iris surface. This finding may be regarded as typical of a distinct cate-

gory of traumatic cataract. The contusion cataract of the anterior lens capsule is illustrated photographically in figure 1.

Although the iris, at its free margin, lies practically in contact with the anterior surface of the lens, yet there is a thin layer of aqueous intervening. Therefore, pressure directed upon the anterior aspect of the eyeball, however great and however sudden in origin, must, according to the laws of physics, be distributed equally throughout the globe. Because of the free communication of the anterior and posterior chambers through the pupil, it should not be possible for any pressure change within the eye to force the iris

against the lens, for the equal distribution of pressure throughout the globe would result in as great a pressure being exerted away from the lens from the posterior chamber as toward it from the anterior chamber. However, this conception of the ocular hydrodynamics fails to consider the fact that the eyeball is a structure of living tissues whose physiologic activity considerably modifies the operation of purely physical laws. In the closed space of the living eyeball, the intraocular pressure is maintained by the circulation of blood through the vascular system, the secretion of aqueous by the ciliary body (in turn dependent upon the circulation), and the drainage of aqueous through Schlemm's canal and the venous system. Sudden pressure upon the eyeball, by increasing the intraocular pressure, cuts off the arterial circulation, reduces the secretion of aqueous by the ciliary body, and forces the exit of aqueous through the drainage channels. As the aqueous drains from the anterior chamber, it is replaced by fluid from the posterior chamber which, due to slowing of the circulation through the ciliary body, is not renewed. Therefore, the iris may be forced against the lens in all or part of its pupillary circumference. In this fashion, the ring cataract of Vossius may originate. However, the physiologic modification of physical hydrodynamics within the eye would hardly appear to be adequate to account for the forceful application of the entire posterior iris surface against the anterior surface of the lens.

To provide physical conditions that would make such a movement of the iris possible, the force producing a pressure change would have to become operative after the escape of fluid from the eye had been effected. With rupture of the eyeball, the continued application of pressure would cause the aqueous to be forced from the anterior chamber through the

wound. At the same time, movement of the aqueous through the pupil into the anterior chamber would empty the posterior chamber of fluid. With the emptying of the posterior chamber, continuing pressure would then force the iris against the anterior surface of the lens at the same time draining aqueous from the anterior chamber until, if the pressure-producing force acted for a sufficiently long period of time, the cornea would eventually be applied to the anterior surface of the iris.

In the case here reported, conditions would appear to have been ideal for driving the entire iris against the lens. Rupture of the globe was accomplished by metallic particles driven through the cornea by a blast of air under pressure. How ideal these conditions were is obvious if it is assumed that the metallic particles struck the eye with the initial current of compressed air which then continued its force until turned away by the patient. Only a very short period of time was needed for such a force to empty the aqueous from the posterior chamber and drive the iris against the anterior surface of the lens. Absence of even the slightest macular damage is strong evidence favoring this theory, for it is reasonable to suppose that the force of a 50-pound stream of compressed air would surely have damaged the macula by contrecoup if the globe had not been opened at the very instant of the blast.

Contusion cataract of the anterior lens capsule, therefore, appears to originate in trauma which exerts a force continuing for a period of time after it has effected rupture of the globe. Circumstances which produce trauma of this type must be of most infrequent occurrence. Hence this variety of traumatic cataract should be a great rarity.

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A STATISTICAL REVIEW OF 367 BLINDED SERVICE MEN, WORLD WAR II

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The following statistics were compiled from the first 367 consecutive admissions of blinded service men of the Army to Old Farms Convalescent Hospital (Special), Avon, Connecticut. If all the World War II blinded, of which there will be approximately 1,000, were included in this review, some variations would be noted in the distribution, causes, and so forth, particularly in those cases due to disease. However, it is felt that this number of consecutive admissions will present quite an accurate picture of those blinded in the present war.

Early in World War II, two Army general hospitals were designated as centers for the medical and surgical care of the Army blinded. These hospitals were Valley Forge General Hospital, Phoenixville, Pennsylvania, and Letterman General Hospital, San Francisco, California. The blinded activity at Letterman General Hospital was transferred to Dibble General Hospital, Menlo Park, California, upon activation of the latter in 1944, while Valley Forge General Hospital continues to operate as a center for the blinded. At these two centers, concurrent with medical and surgical treatment, the blinded are given preliminary social-adjustment training consisting of Braille reading, typing, orientation, occupational

therapy, and related subjects. Upon completion of hospital treatment, the blinded are transferred to the advanced social-adjustment training center for the blinded at Old Farms Convalescent Hospital (Special), Avon, Connecticut, which was activated June 14, 1944.

The advanced social-adjustment training consists of a continuation of the adjustment begun in the two blinded centers referred to, and, in addition, there are available approximately 50 subjects and try-out jobs from which the trainee may select as many as he desires or is capable of pursuing. Among these are wood working, machine-shop work, factory jobs, counseling, guidance, business management, vending-stand operation, agriculture, book-binding, music, and similar occupations. Upon completion of advanced social adjustment, which requires approximately 18 weeks, the blinded man is discharged from the service and returned to his home.

DEFINITION OF BLINDNESS

A service man is classified as blinded or industrially blinded when central vision in the better eye is reduced to 20/200 and is not correctable, or when peripheral vision is reduced to 20 degrees or less

even though central vision is better than 20/200.

Low vision. An individual classified as blinded is referred to as having low vision when, in the better eye, vision ranges between moving objects and 2/200. Those having light perception only are, for practicable purposes, classified with the totally blinded.

Useful vision. An individual classified as blinded is referred to as having useful vision when, in the better eye, vision ranges from 3/200 to 20/200, whether it be central, peripheral, or both. In general, it is considered that individuals falling in this group can engage in various types of occupations in a manner approaching the sighted, and travel about the country without an escort. Their efficiency in this respect naturally increases in proportion as vision nears 20/200.

PLACES WHERE BLINDNESS WAS INCURRED

In so far as this report is concerned the European Theater of Operations includes England, Iceland, Greenland, France, Germany, Holland, and Belgium. The Mediterranean Theater includes North Africa, Italy, and the Middle East. The Pacific Theater includes all areas in which the Japanese were engaged in action, and the Zone of the Interior refers to the continental limits of the United States.

Blinded, residual of enemy action. Of the 367 blinded considered in this report the following percentages occurred as the result of enemy action:

European Theater	162 (44.14%)
Mediterranean Theater	46 (12.53%)
Pacific Theater	26 (7.08%)
Total	234 (63.76%)

Enemy agents through which blindness was incurred were as follows:

Booby-trap explosion	9
Bullet, machine gun, and rifle	32
Bazooka-shell explosion	5
Concussion, exploding shells, no external injuries	2
Flack and gun fire from enemy plane	5
Hand- and rifle-grenade explosion	13
Land mine explosion	41
Mortar-shell explosion	28
Shrapnel	24
Shell fragments, type of shells unknown ..	74
V-2-bomb fragments	1
Total	234

Blinded, residual of accident. Of the cases of accidental blindness, 37 can be justly classified as incidental to training. Accidental blindness was incurred in the various theaters as follows:

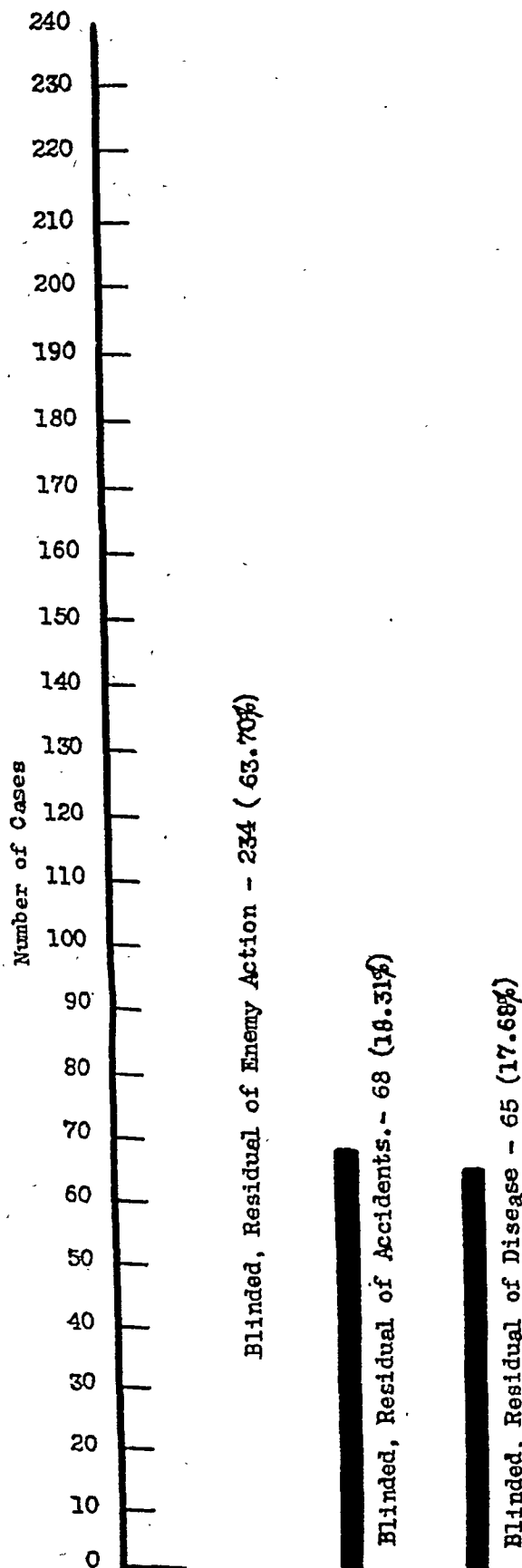
European Theater	14 (3.81%)
Mediterranean Theater	7 (1.91%)
Pacific Theater	11 (2.99%)
Zone of the Interior	36 (9.80%)
Total	68 (18.51%)

The following types of accidents resulted in blindness:

Airplane crash	1
Ammunition explosion (shells, cartridges) ..	8
Booby-trap explosion	4
Blasting-cap explosion	3
Dynamite explosion (catching fish for mess)	4
Dynamite explosion	4
Detonator-cap explosion	2
Gasoline fumes (high-octane gas, containing lead)	2
Gun shot	6
Grenade explosion	3
Knife wound, opening can	1
Kicked in face by mule	1
Land-mine explosion	3
Motor-vehicle accident	3
Methyl alcohol, ingestion of	14
Retinitis, solar	1
Struck in face with stick	1
Struck in eye with wrench	1
Struck in eye with garden hose	1
Struck in face with bottle	1
Struck by lightning	1
TNT explosion	3
Total	68

Blinded, residual of disease. Blindness as a result of disease occurred in:

European Theater	10 (2.72%)
Mediterranean Theater	4 (1.09%)



Pacific Theater	7 (1.91%)
Zone of the Interior	44 (11.98%)
Total	65 (17.70%)

Diseases through which blindness was incurred were as follows:

Atrophy of the optic nerve, cause obscure	14
Atrophy of the optic nerve, following try- parsamide therapy	1
Atrophy of the optic nerve, residual of brain tumor	1
Atrophy of the optic nerve, residual of encephalomyelitis following vaccinia	1
Atrophy of the optic nerve, residual of retrobulbar neuritis following spinal an- esthesia	1
Atrophy of the optic nerve, residual of epidemic cerebro-spinal meningitis	2
Atrophy of the optic nerve, residual of beriberi contracted in Japanese prison camp	4
Choroido-retinitis, syphilitic	1
Choroido-retinitis, cause obscure	6
Degeneration, macular	9
Gun-shot wound, self-inflicted	1
Keratitis, interstitial	1
Neuritis, retrobulbar, cause obscure	7
Retinitis, hemorrhagic	2
Retinitis, hemorrhagic (Eales's disease) ..	2
Retinitis proliferans	1
Retinitis pigmentosa	6
Sclerosis, multiple	2
Thrombosis, cilioretinal artery	1
Uveitis	1
Total	65

Eleven cases of blindness as the result of enemy action were due to occipital-lobe injuries without complicating injuries to the optic nerves or globes.

In the case of blindness due to injury incident to opening a can with a knife, the patient had, at the time of injury, a macular degeneration of the other eye with vision reduced to counting fingers at 12 inches. The injured eye was enucleated.

In one case of blindness due to gun-shot wound of the eye, the patient had undergone an enucleation of the other eye prior to the accident.

Chart 1 (Thorne). Showing whether blindness was due to enemy action, accident, or disease.

The patient who had been blinded by a blow in the eye with stick had an amblyopia ex anopsia of the other, with vision reduced to 2/200.

the eye by a mule had an amblyopia ex anopsia of the other, with vision reduced to 4/200.
In the case of blindness caused by

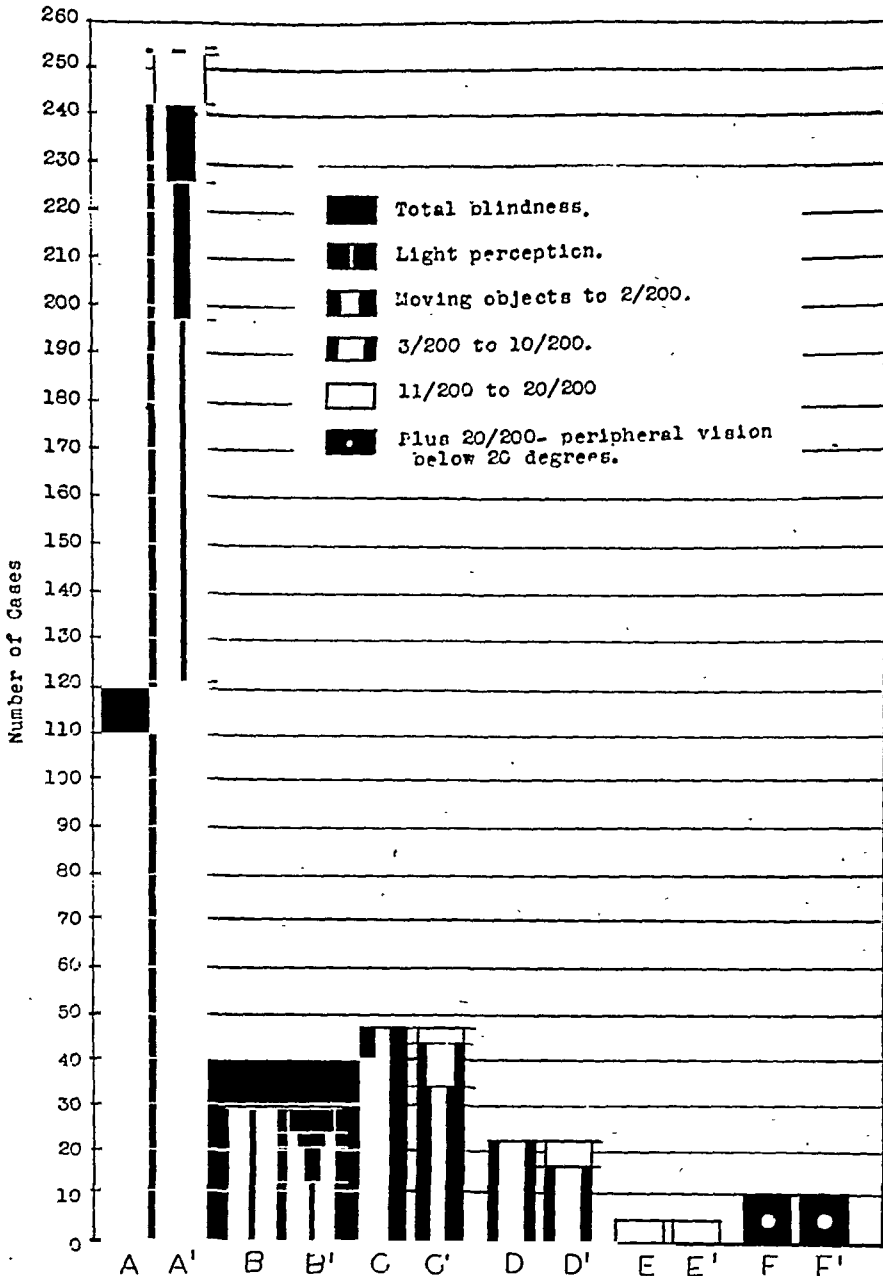


Chart 2 (Thorne). Degree of blindness encountered in the 367 cases considered.

The patient who was blinded by a blow in the eye with a garden hose had an amblyopia ex anopsia of the other, with vision reduced to 20/200.

thrombosis of the cilioretinal artery, the patient had undergone, prior to onset, an enucleation of the other eye.

The patient blinded by being kicked in

Two cases of blindness caused by concussion induced by exploding shells pre-

sented bilateral macular degeneration with normal peripheral vision as to extent.

The patient who was blinded by being struck by lightning presented bilateral optic-nerve atrophy as a residual.

In the case of blindness due to a blow in the eyes with a bottle, one eye had to be enucleated and a massive detachment of the retina occurred in the other; vision was reduced to light perception.

The patient whose blindness was due to a blow in the eye with a wrench had a high myopia of the other eye with vision reduced to 4/200.

One case of blindness which occurred in the Pacific Theater was due to a self-inflicted gun-shot wound of the orbits during a period of acute mental depression.

Of the 367 patients considered, 47 (12.80 percent) had both eyes enucleated, one had both eyes eviscerated, and 147 or 40.05 percent had one eye enucleated. Binocular phthisis bulbi was found in 18 (or 4.90 percent), and monocular phthisis in 66 (or 17.98 percent).

A more detailed explanation of chart 2 follows:

Columns A and A' give data on 254 blinded or industrially blinded service men, A representing one eye and A' the other of the same individuals. A indicates that the 254 (69.20 percent) were totally blinded in one eye, while A' indicates that 121 (32.97 percent) were totally blinded in the other eye as well. Of the remaining 133 in the A' column, 76 (20.79 percent) retained light perception; 29 (7.71 percent) retained vision ranging from moving objects to 2/200; 16 (4.35 percent) retained vision ranging from 3/200 to 10/200; 11 (2.99 percent) retained vision ranging from 11/200 to 20/200, while 1 (.27 percent) retained vision better than 20/200 but with peripheral vision reduced to 20 degrees or less.

Columns B and B' give data on 29 industrially blinded service men, B representing one eye and B' the other of the same individuals. B indicates that 29 (7.90 percent) represented retained light perception in one eye while B' indicates that 13 (3.81 percent) of these retained only light perception in the other eye as well. Of the remaining 16 in column B', 8 (2.17 percent) retained vision ranging from moving objects to 2/200; 3 (.81 percent) retained vision ranging from 3/200 to 10/200; while 5 (1.36 percent) retained vision ranging from 11/200 to 20/200.

Columns C and C' give data on 47 industrially blinded service men, C representing one eye and C' the other of the same individuals. C indicates that the 47 (12.80 percent) retained vision ranging from moving objects to 2/200 in one eye, while C' indicates that 34 (9.26 percent) retained the same range of vision in the other eye as well. Of the remaining 13 in column C', 9 (2.45 percent) retained vision ranging from 3/200 to 10/200, and 4 (1.09 percent) retained vision ranging from 11/200 to 20/200.

Columns D and D' represent 22 industrially blinded service men, D representing one eye and D' the other of the same individuals. D indicates that the 22 (5.99 percent) represented retained vision ranging from 3/200 to 10/200 in one eye, while D' indicates that 17 (4.63 percent) of these retained the same range of vision in the other eye as well.

Of the remaining 5 (1.36 percent) in the D' column, all retained vision ranging from 11/200 to 20/200.

Columns E and E' represent five industrially blinded service men, E representing one eye and E' the other of the same individuals. E and E' indicate that the 5 (1.36 percent) represented retained vision in both eyes ranging from 11/200 to 20/200.

Columns F and F' represent 10 industrially blinded service men, F representing one eye and F' the other of the same individuals. F and F' indicate that the 10 (2.72 percent) represented retained central vision better than 20/200 in both

202 consecutive admissions, this being the number of men who had completed training and were separated from the service at the time this report was prepared.

The following standards were used to evaluate an individual's response to train-

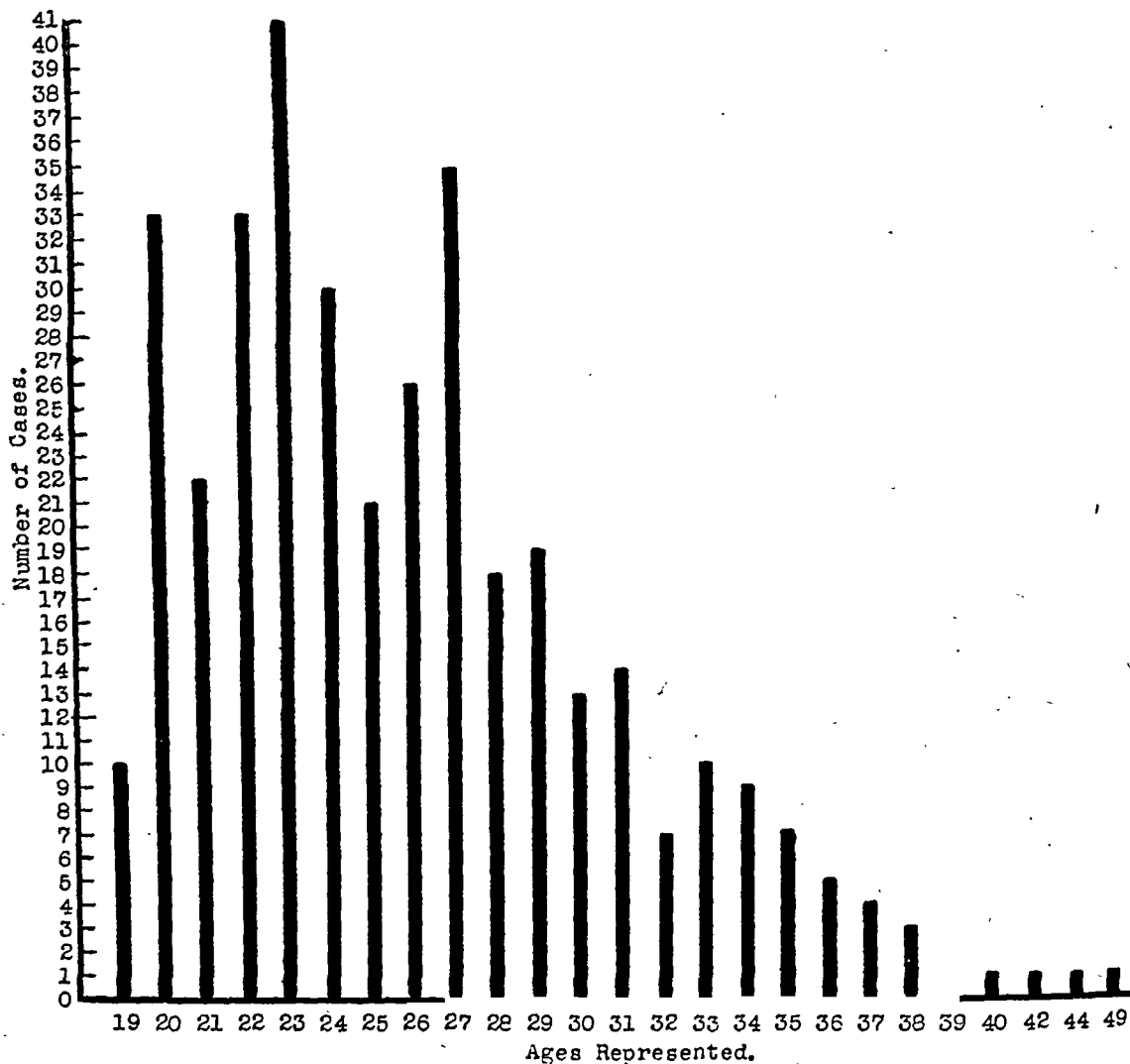


Chart 3 (Thorne). Ages of 367 service men blinded in World War II.

eyes, but with peripheral vision reduced to 20 degrees or less.

In chart 3, it will be noted that of the 367 service men who were blinded 288 (78.47 percent) were below 30 years of age.

RESPONSE TO TRAINING

This portion of the report, which is concerned with training, considers only

ing: (1) Ability to orient well. (2) Determination to accept a minimum of assistance. (3) Eagerness for activity, both social and vocational. (4) Control of unwholesome antisocial habits. (5) Genuine self-confidence in capabilities and self-assurance in ability to hold a job. (6) Insight into limitations and potentialities. (7) Ability to get along with others in the community.

In rating individuals according to these standards, a seven-point score was used: Superior, excellent, very satisfactory, satisfactory, unsatisfactory, unadjustable, and incorrigible.

It will be noted in chart 4 that of the 202 blinded men whose training was completed, 160 (79.37 percent) were given a rating of satisfactory or better in respect to the results of training for rehabilitation.

A rating of unsatisfactory was given when it was felt that the blinded man did not quite measure up to the standard established and could not be considered as adjusted to his blindness. However, it was considered possible, and in some cases quite likely, that a satisfactory adjustment would eventually be made.

Of those given the grade of unsatisfactory, defects such as the following were frequently found by the psychologist: "Confused and fearful, poor home environment, poor background, irresponsible, immature, and chronic alcoholism." The average score attained by this group in the Army General Classification Test was 86.4, the highest score attained being 124 and the lowest 54. Two trainees in this group attained the score of 124. One of these had sustained a severe brain injury and was disturbed, fearful, and anxious. The other was immature, confused, and unrealistic. The trainee who attained the score of 54 was unstable, irresponsible, and had a poor home background. The average score attained in the Wechsler-Bellevue Test was 102, the highest score being 124 and the lowest 73.

The rating of unadjustable was given when the blinded man was considered to be not adjusted, and further, not adjustable nor trainable. Mental defectives and those severely disturbed emotionally were placed in this category.

Of those given the grade of unadjustable, defects such as the following were

frequently found by the psychologist: "Rejects blindness, mental defective, severe brain injury, and psychoneurotic." The average score attained by this group in the Army General Classification Test was 65.7, the highest score being 95 and the lowest 39. The trainee whose score was 95 was a hypochondriac, was fearful

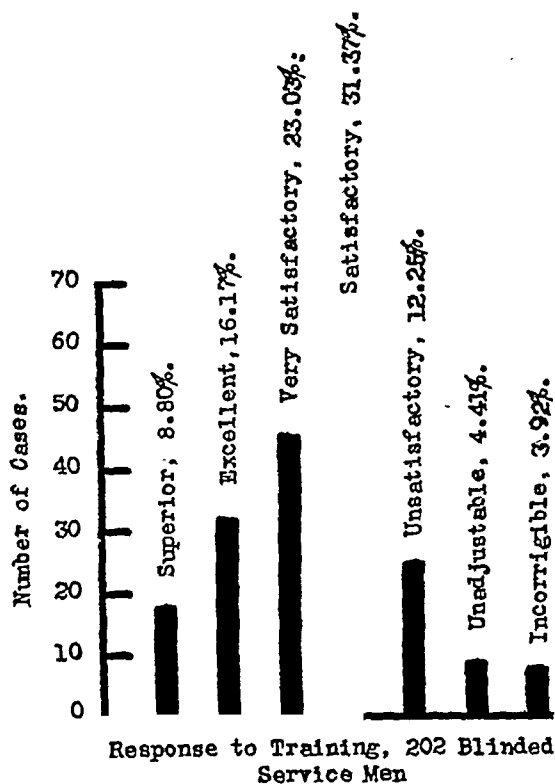


Chart 4 (Thorne). Ratings of 202 blinded service men with respect to training for rehabilitation.

and dependent; and the trainee who attained the score of 39 was mentally defective and a psychoneurotic. The average score attained by this group in the Wechsler-Bellevue Test was 84.2, the highest score being 104 and the lowest 62.

The rating of incorrigible was given when the blinded man displayed antisocial behavior patterns or serious alcoholism.

Of those given the rating of incorrigible, defects such as the following were commonly found by the psychologist:

“Psychopathic, psychoneurotic, emotionally disturbed, alcoholism, and delinquent.” The average score attained by this group in the Army General Classification Test was 86.5, the highest score being 98 and the lowest 72. The trainee who attained the score of 98 was a delinquent, was psychopathic, and a chronic alcoholic; and the trainee who attained the score of 72 was a chronic alcoholic. The average score attained by this group in the Wechsler-Bellevue Test was 102.1, the highest score being 120 and the lowest 95.

SUMMARY

Number of blinded upon which report is based	367
Blinded, result of enemy action	234 (63.76%)
Blinded, causes other than	

enemy action (accident and disease)	133 (36.21%)
Totally blinded and retaining light perception only	210 (57.22%)
Low vision retained (vision of little or no value)	71 (19.34%)
Useful vision	86 (23.42%)
Both eyes enucleated or eviscerated	47 (12.80%)
One eye enucleated	147 (40.05%)
Phthisis bulbi, both eyes	18 (4.90%)
Phthisis bulbi, one eye	66 (17.98%)

Number of blinded below 30 years of age	288 (78.47%)
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Percentage of blinded who made a satisfactory or better adjustment ..	79.37%
Percentage of blinded who made an unsatisfactory adjustment	12.25%
Percentage of blinded considered as unadjustable	4.41%
Percentage of blinded considered as incorrigible	3.92%

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NOTES, CASES, INSTRUMENTS

OPERATIVE PROCEDURE FOR SUBLUXATED LENS

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The subluxated lens, or tremulous lens, according to Duke-Elder,¹ occurs when the suspensory apparatus is weakened so that the lens becomes tremulous, or subluxated, but remains within the pupillary aperture. This is to say that some of the suspensory ligament does not remain intact. The usual surgical procedure for the removal of such lenses is by spoon or loop extraction or, if the patient is younger, by discission. Dutt² discussed the nonviolent delivery of the subluxated lens by the lever-action intracapsular route. By this method, the lens is removed from the anterior chamber after iridectomy by rotating it through the corneal wound, using the attached zonule as the fulcrum and providing pressure on the globe below. Knapp's³ paper on the operative treatment of congenital subluxated lens reviews the types of operations from which to choose. The first was an iridectomy to give a clear zone in the aphakic area through which to see. The second is discission, which is very difficult because the lens eludes the end of the knife; there is no tension on the capsule; and the opening is small. Moreover, the incision does not remain open, and several operative procedures are usually necessary. Knapp states that needling should be done in adolescence only. The third choice is removal of the lens by spoon or loop extraction. The indications for operation are cyclitis, glaucoma, or poor vision.

The procedure under discussion consists of the usual keratome incision with McLean suture. The incision is enlarged

with the scissors. Iridectomy is then performed at the 12-o'clock position with the use of a blunt iris hook to engage the iridic margin. The iris is drawn up into the incision and the iridectomy performed. During the entire operative procedure, it is necessary that the assistant hold the lids away from the globe. After the iridectomy is performed, an Arruga forceps is used to enter the anterior chamber; the upper margin of the subluxated lens is grasped, and the lens withdrawn from the anterior chamber by the intracapsular route.

The causes for subluxation of the lens can be congenital, traumatic, and consecutive or spontaneous. The findings are a deep anterior chamber, iridodonesis. The convex edge of the lens can usually be seen in some part of the pupillary aperture. Monocular diplopia may be present.

REPORT OF CASE

A white man, single, aged 37 years, was first seen in the office on December 30, 1944. He said that he had had poor vision in his left eye for a number of years and, about four weeks previous to this date, the visual acuity in his right eye suddenly diminished. The eye had been moderately red since that date. The patient did not report loss of vision in his left eye. He did not have monocular diplopia. He had not suffered trauma but had been doing heavy labor, part of which consisted of carrying 100-lb. sacks on his shoulders. This, we think, could traumatize a congenitally weak suspensory apparatus sufficiently to allow the lens to subluxate.

On examination, it was found that this man had a bilateral dislocation of both lenses. The anterior chamber was deep and iridodonesis was present. The superior margin of the lens could be seen in

each eye, covering about two thirds of the pupillary aperture. The pupil of the right eye was widely dilated and fixed to light, but the left eye was normal in size and reacted to light. There was a mild ciliary congestion of the right eye. The tension in the right eye was 15 mm. Hg (Schiotz); in the left eye 13 mm. The fundus, viewed through the aphakic portion, appeared normal in both eyes.

The patient was not wearing glasses. His vision, with squinting, was 20/300 in the right eye; 20/200, in the left. Atropine, to be used twice a day in the right eye, was prescribed, and the patient was advised to use hot packs and return on January 2d for the surgical removal of the dislocated lenses.

Family history revealed that this man's maternal grandmother had undergone an operation for dislocated lenses 50 years ago. His mother and two of his uncles had dislocated lenses. The mother had an operation on both eyes, one of them successful, about 40 years ago. One of the uncles had also been operated upon successfully about 40 years ago. The second uncle was under regular observation by a physician. The patient had six brothers and one sister. Two of the brothers had dislocated lenses but refused operative procedures, for they were comfortable and had good vision with glasses. A family characteristic was height of about 6 ft.

Physical examination revealed a tall, thin man, weight 145 lbs. (65.9 kg.), height 73 in. (185 cm.), with a long, thin trunk and arms of greater than normal length. This patient fits the description of Marfan's syndrome.

On January 2d, the lens of the left eye was extracted under local anesthesia. During the operative procedure, the lens tilted into the anterior chamber and was very easily grasped with the Arruga for-

ceps and removed. It was not necessary to assist the removal of the lens in any other way. The position of the lens was viewed through the cornea, not by direct vision. A bead of vitreous showed in the wound at the conclusion of the operation. However, it was not cut off, and the eye was bandaged with a dry dressing. The dressing was changed on the second postoperative day. The prolapse of vitreous was not marked, but had increased somewhat and, on the third postoperative day, the protruding vitreous was touched with a heated muscle hook.

The patient was very anxious to have the lens removed from his right eye. On January 8th, a similar operation was performed on the right eye without prolapse of vitreous. A McLean suture sealed the wound satisfactorily. The postoperative course was uneventful, and the patient was discharged from the hospital on January 13th, with some gaping of the wound of the left eye at the point of the prolapse of the vitreous. He was not seen again until January 22d, when vision was: R.E. with a +13.00D. sph., 20/50; L.E., with a +13.75D. sph. \ominus -2.75D. cyl. ax. 60°, 20/40. He still had some irritation of the right eye. He was given atropine; and also typhoid antigen H (20 million organisms) intravenously.

He was then seen at weekly intervals, and the right eye gradually cleared. He wore temporary lenses in the form of spheres until April 13th, when permanent lenses were prescribed. Vision was: R.E., with a +14.25D. sph. \ominus -1.25D. cyl. ax. 110°, 20/40; L.E., with a +14.75D. sph. \ominus -1.25D. cyl. ax. 45°, 20/30. An addition of +2.75 D. sph. was given for close work. Binocular vision, was 20/25-2. The patient stated that he saw better than he ever had in his life.

908-9 Hulman Building (18)

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UNUSUAL COMPLICATION OF SPHENOPALATINE BLOCK

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The present report is concerned with a complication of sphenopalatine, or maxillary-nerve block, evidently not of frequent occurrence. In performing this procedure, it has been customary in our experience to enter the needle into the palatine foramen in an upward direction, passing it through the pterygopalatine canal into the pterygopalatine fossa to a depth of about 3 cm. From 2 to 2½ c.c. of a 1-percent solution of novocaine is usually injected. The anesthesia produced is useful in dental surgery; in nasal surgery, both alone and as an adjunct to topical application of cocaine; in the treatment of sphenopalatine neuralgia; and, finally, in the treatment of ocular pain. It is possible for the needle, if carried too far, to pass through the pterygopalatine fossa into the inferior orbital fissure. The effects obtained when this occurs will depend on the precise site of deposition of the anesthetic agent. Two cases are here presented in which temporary paralysis of the external rectus muscle was produced by the injection described.

Case 1. Novocaine (2½ c.c. of a 1-percent solution) was injected on the left side

in the manner described as preliminary to dental surgery. Five minutes later, the patient complained of double vision. On examination, 15 minutes later, he was found to have complete paralysis of the external rectus muscle on the side injected. There was complete corneal anesthesia. The pupil was slightly irregular, somewhat larger than that of the fellow eye, and slightly sluggish in response to light and accommodation. Ocular examination was otherwise completely negative. Two hours later, the diplopia was no longer in evidence; ocular movements were normal in all directions of gaze; corneal sensitivity had returned; and the pupils were equal and regular and responded actively to light and accommodation.

Case 2. A patient received an injection of 1 c.c. of a 1-percent solution of novocaine and of 1 c.c. absolute alcohol into the pterygopalatine fossa in treatment for sphenopalatine neuralgia. Almost immediately, the patient complained of double vision. Examination revealed complete paralysis of the external rectus muscle. Pupils were equal and regular and reacted to light and accommodation. Corneal reflexes were retained. The paralysis of the external rectus receded gradually over a period of two days. The patient was returned to duty nine days later without complaint.

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RECURRENT DETACHMENT OF THE CHOROID FOLLOWING TREPHINING OPERATION*

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New York

In 1868, Herman Knapp diagnosed sarcoma of the choroid in an eye following cataract extraction which, on section, proved to be a choroidal detachment. Similar reports by competent ophthalmologists have appeared as recently as 1934. Operations or injuries that induce marked reduction in intraocular pressure have long been recognized as occasionally giving rise to choroidal separation. This separation was looked upon as a transient phenomenon that disappeared in several days following wound closure and the establishment of normal intraocular pressure.

When Elliot's trephining operation for chronic noninflammatory glaucoma gained acceptance, observers reported that choroidal separation not only occurred frequently, but that the detachments often were of longer duration. Prior to the use of corneoscleral sutures, few observers had the courage to examine fundi earlier than one week after cataract extraction, whereas ophthalmoscopy sooner after trephination was entirely safe. O'Brien¹ found transient separation of the choroid in 93 percent of his cataract-extraction series. Although Elliot admitted reluctantly that the complication occurred in about 3.5 percent of trephining operations, the reports of Bothman and Blaess,² Rycroft,³ and Rubert⁴ showed an incidence varying from 14 to 50 percent.

According to Fuchs, a rent in the perichoroidal space followed by transudation

of fluid from the choroidal vessels produces the detachment which disappears when the leaking surgical section heals firmly. Spaeth and DeLong⁵ believe that choroidal detachment "may be due to massive edema, a disturbance of the perichoroid or hemorrhagic choroiditis or a combination of the three conditions." They suggest "massive perichoroidal edema" as a more correct designation for postoperative and posttraumatic conditions not essentially hemorrhagic.

It is generally accepted that most postoperative detachments of the choroid disappear completely within three to seven days. However, many cases are reported of anterior chambers that remained open for six weeks or even six months with persistence of the choroidal separation. Stress has not been laid upon the danger of such a prolonged complication. Failure of the anterior chamber to re-form creates an abnormal situation giving rise to low-grade uveitis, synechia in the anterior angle, and lens-capsule and cortex opacities. Persistent detachment of the choroid is delineated by pigment granules and streaks seen ophthalmoscopically, and later by actual degenerative changes in the choroid and retina. Secondary hemorrhage and absolute glaucoma may develop, causing blindness and necessitating enucleation.

In view of these possibilities, concern must be expressed at the therapeutic suggestions appearing in ophthalmic textbooks. For treatment of choroidal separation Berens advises "keeping the patient in bed;" Elliot recommends "getting the patient out of bed;" and Parsons dismisses the subject by stating that "most patients get well without treatment." Verhoeff and others recommend scleral puncture to effect reposition by withdrawing serous fluid in the perichoroidal space. The procedures having the soundest surgical basis are cauterization of the tre-

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Read in part before the New York Society for Clinical Ophthalmology, February 5, 1945.

phined bleb or covering it with a flap of conjunctiva or a strip of superior-rectus tendon. Disagreement exists regarding the safe period before effecting closure of a fistulizing wound. Rycroft believes that a trephine leak should be sealed off after seven days, whereas Duke-Elder suggests repair if the choroidal detachment has persisted for three months!

A warning should be sounded against these extreme views. The danger of prolonged bed rest, particularly in aged patients, cannot be overemphasized. In addition, the upright position, by gravity, decreases the amount of fluid lost through the open wound. Intervention seven days postoperatively is unwarranted. I know of one case wherein premature and excessive cauterization precipitated a fresh attack of glaucoma. Excessive delay for three months can lead only to the complications mentioned above. Choroidal separation and failure of the anterior chamber to re-form two weeks after trephination must be regarded seriously. Mild cauterization of the conjunctival wound edges is indicated and may be repeated every third day if necessary. When this treatment is not effective within two weeks, the trephine bleb should be covered with a flap of conjunctiva or superior-rectus tendon.

CASE REPORT

A 1½-mm. trephination of the right eye (May 4, 1943) was effective in reducing intraocular pressure for six weeks and, despite daily use of miotics, the pressure was controlled for only one year. On June 9, 1944, a 2-mm. trephining operation was performed 4 mm. temporal to the former site. The globe was too soft for accurate ophthalmoscopy until the sixth day, when detachment of the choroid was observed in the inferior portion rising almost to the inferior edge of the optic nerve. Two days

later the anterior chamber re-formed, the choroid appeared to be replaced, the patient left the hospital, and vision improved from perception of fingers to 20/100. After six days, detachment again occurred which lasted 48 hours. On July 4th, excessive tearing was present, followed by visual veiling and distortion which persisted for 12 hours.

The fourth detachment on July 21st cleared in two days, with recovery of vision to 20/50+2. Two transient spells of tearing, veiling, and distortion were observed by the patient in August. The fifth and last detachment was seen on September 11th, three months after the operation.

Vision in the left eye with glaucomatous optic-nerve atrophy was 3/200 in a 15-degree temporal sector only. Some apprehension was felt regarding the ultimate outcome in the patient's only useful eye. Procedures considered were cauterization of the bleb and Magitot's⁶ operation for covering trephine opening with a strip of superior-rectus tendon. The possibility of wound closure with return of glaucoma suggested that conservatism would be the wiser choice. Treatment, therefore, was limited to continual *ad maximum* dilatation of the pupil of the right eye, using 1-percent atropine followed by paredrine three times daily. The outstanding clinical finding observed since the operation was the appearance of a fixed arc of pigment granules corresponding to the summit of the choroidal detachment. The nasal half of this pigment line disappeared after two months, and at present only several fine pigment dots are noted in the choroid 2½ disc diameters inferior to the optic nerve, with evidence of thinning of the choroid due to atrophy. Hypotony was present for four months, when a small bleb appeared over the site of trephination and the tension rose to 20 mm. Hg

(Schiøtz), which has been maintained to date. The field of vision is fuller at present than it was preoperatively, and there is a 15-degree contracture superonasally and one 20 degrees superotemporally. Three diopters of myopia⁷ have developed since operation, and with full correction the vision is 20/50— due to the sclerosis of the lens nucleus, which was noted

before operation. At first dressing an interesting clinical finding was the almost complete loss of the normal upper-lid convexity. This defect has persisted to a lesser degree and is probably associated with a loss of scleral curvature about the zone of operation.

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SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

COLLEGE OF PHYSICIANS OF PHILADELPHIA

SECTION ON OPHTHALMOLOGY

October 18, 1945

DR. WARREN S. REESE, *chairman*

NEUROFIBROMATOSIS IN THREE CONSECUTIVE GENERATIONS

DR. EDITH HARVEY (by invitation) presented the case of a girl, 5 years of age, who entered the clinic, with a history of gradual protrusion and deviation downward of her left eyeball. She was an intelligent, healthy child, having had none of the usual childhood diseases except occasional colds. A tonsillectomy had been performed the previous year.

On examination, there was an exophthalmos of the left eye measuring 3 mm., with the visual axis directed downward 30° and temporally 5°, while the visual axis of the normal eye was directed straight forward. Ocular rotations were fairly good in all fields except that of the superior rectus, in which there was definite limitation. Visual acuity was 20/30 in the normal eye and 1/200 in the exophthalmic eye. There was a definite unilateral papilledema in the left eye. She had café-au-lait pigment spots on her chest and abdomen, but no subcutaneous neurofibromata.

Blood count and urinalysis were normal, as were the serum, calcium, and phosphorus determinations.

Roentgenographic studies of the orbit showed no bone involvement, except some slight enlargement of the optic foramen on the involved side. The sphenoidal ridges were normal, and the bones of the skull showed no abnormalities. There

was no evidence of calcification. Roentgenographic studies of the sinuses were normal.

The patient was operated upon by Dr. E. B. Spaeth. A neurofibroma was found encircling the entire intraorbital portion of the optic nerve from its exit from the eyeball to the optic foramen. The eyeball and optic nerve up to the foramen were removed. The tumor mass, which was about 9 mm. in diameter along the entire length of the nerve, seemed to be constricted to the normal size of the nerve at the optic foramen, and it is to be hoped that it did not involve the intracranial portion of the nerve.

No other tumor masses were palpable in the orbit.

Microscopic sections of the enucleated eyeball and optic nerve showed an intact, undamaged optic nerve with a pure fibroma, containing no nerve fibers, surrounding it. There was, in addition, edematous infiltration of the nerve heads. The slides of these sections were discussed later in detail by Dr. DeLong, under whose direction they were made and carefully studied.

The mother of the child had multiple, cutaneous neurofibromata, most numerous over her back, but scattered also on her abdomen, neck, and extremities. Many had been present since birth; others appeared at puberty. She had a few café-au-lait spots on her abdomen. One of the tumor masses on her arm was removed, and the microscopic diagnosis was neurofibroma. When a similar tumor had been removed some years previously, the same microscopic report had been given.

The child's grandfather, on the maternal side, had died at the Presbyterian

Hospital. He had had a suboccipital craniotomy for neurofibromatosis of the middle and posterior fossae. Necropsy findings included: generalized neurofibromatosis, gastric subserous neurofibroma, and a cervical perineural fibrosarcoma.

The antecedent relatives lived in Norway, and the only history obtainable was the recollection of the child's mother that she had heard that her own grandmother, on the paternal side, had had several nodular masses on her face. Whether these were neurofibromata is, of course, impossible to determine.

The brother of the child, and the sisters and brothers of the mother, have no known abnormalities suggestive of neurofibromatosis.

Dr. Harvey pointed out that neurofibromatosis is an hereditary and sometimes familial condition characterized by skin lesions and tumors on nerves. These lesions she discussed in detail, and presented a brief résumé of the general symptoms.

She also stated that this disease is congenital, showing Mendelian dominance in successive generations, although occasionally one is skipped. There is no sign of sex-linked inheritance.

There seems to be a congenital defect which exists in the nerve-sheath tissue, resulting in a hyperplasia of the nerve-sheath connective tissue, the cells being adult in type and not embryonic. The stimulus for hyperplasia is present from birth. New tumor masses may appear at puberty, pregnancy, or with intercurrent infections. They are not stimulated by local trauma.

The origin of these tumors has been a matter of controversy which is still not settled. Von Recklinghausen believed that the tumors were mesoblastic in origin, arising from the endoneurium. Verocay considered them as ectodermal derived from the cells of the sheath of Schwann.

According to Penfield and Young they are the result of a connective-tissue reaction about the fibers of the nerves, and show both nerve fibers and connective-tissue elements, although the differentiated fibroblast, and not glial cell, is the typical cell. Whether cells of the sheath of Schwann are specialized glial cells or not is still a disputed question.

Sarcomatous changes have frequently occurred in neurofibromatosis. Operative removal of a neurofibroma may be followed by the recurrence of a benign neurofibroma. On the other hand, sarcomatous transformation may occur at the site of removal or in a distant preëxisting fibromatosis nodule. Metastasis is relatively infrequent, when a benign neurofibroma becomes sarcomatous; instead it is followed by transformation into sarcoma of a neurofibroma in another part of the body.

Discussion. Dr. Perce Delong said that this multiple tumorous syndrome is a disease of congenital origin characterized by cutaneous pigmentation and multiple tumors of cranial and peripheral nerves. The growths in Von Recklinghausen's disease are not true neuromas, which must consist of both nerve tissues and nerve cells, hence the term neurofibromatosis.

Penfield and Young, in describing the involvement of the nerve trunks, meninges, and central nervous system, state that there is found a definite hyperplastic reaction of the cells peculiar to these tissues, indicating that there must have been an irritant or stimulating influence exerted on these tissues, causing hyperplasia, which is followed by true neoplastic growth of these cells.

This specimen does not differ from those reported. The clinical, ocular signs are secondary. These are: exophthalmos, due to pressure from behind; choked disc, due to pressure; degeneration; and optic atrophy. Van der Hoeve is the only one

who reported an ocular manifestation involving the retina.

Pathologic change in this case showed the tunics of the globe to be normal with the exception of one ciliary nerve which presented some edema of the nerve with a thickening of its sheaths. There was also an early papilledema of the nerve head.

The optic nerve presents marked edema of the nerve and definite fibrosis of the sheaths. The hyperplasia is most marked in the region of the arachnoid, giving the nerve the appearance of being about twice its size. Microscopically, no cellular elements are present, but marked hyperplasia and fibrosis of the nerve sheaths.

Dr. E. B. Spaeth said that he again wished to call special attention to the matter of development of sarcoma in neurofibromatosis. He had recently seen two additional cases. The first patient presented before this group about two years ago with neurofibromatosis in the upper division of the 5th nerve, now had developed sarcomatous changes accompanied by severe hemorrhages.

The second patient had a neurogenic sarcoma which seemed to arise in an otherwise benign neurofibroma of the orbit.

The astonishing feature in the cases presented by Dr. Harvey was that one will probably never see three more dissimilar instances of a common hereditary process. In the first case, that of the grandfather, there was a neurogenic sarcoma (sarcomatous changes from neurofibromatosis). In the second case, that of the mother, the lesions were confined purely to the skin. In the third case, the child's, there was a neurofibroma of the optic nerve, itself.

Dr. Francis H. Adler asked Dr. Harvey whether this tumor did not originate in the sheath of the nerve, not the nerve fibers. He added that he would like to

point out that the theory that these tumors start in the neurilemmal sheath must be wrong, at least in the case of the optic nerve, because the optic nerve fibers, like the fiber tracts of the brain, have no neurilemmal sheath. It is not a true sensory nerve.

Dr. Edith Harvey replied that it is now generally believed that neurofibromas arise from the connective-tissue sheaths of the nerves, and not from the neurilemma; that is, they are mesodermal in origin.

A POSSIBLE EARLY CASE OF OCULAR PEMPHIGUS

DR. JOSEPH V. KLAUDER (by invitation) and DR. ALFRED COWAN presented the case of a white woman, aged 29 years, who, since February, 1944, had had recurring erosive areas on the buccal mucosa, the lips, under the tongue, and on the floor of the mouth. These areas disappeared and reappeared at intervals of a few weeks to a few months. When lesions appeared on the lips, she observed that the initial manifestation was a blister which soon ruptured, leaving a crusted surface.

In July, 1945, when first seen, she had a cutaneous outbreak. This was the first time such lesions appeared. On each elbow there was a bleb which was partially collapsed. The skin around the bleb was normal. There was a similar lesion near the external canthus of the right eye. The lower lip was covered with a crust, when this was removed, a moist bleeding surface was seen. On each buccal mucosa, there were marginated superficial ulcerations the surfaces of which were covered with a yellowish membrane. There were no vesicles on the lips nor in the mouth.

In August, during the time lesions were in the mouth and on the skin, both eyes became inflamed. Examination showed intense infection of the palpebral and

bulbar conjunctiva. There was a distinct membrane on the tarsal conjunctiva of the lower lids and on the bulbar conjunctiva on the temporal side. Both upper lids were similarly affected. Examination by slit microscopy showed both corneas clear, there were no vesicles, the aqueous was clear, the iris intact, and the lens unaffected.

Infection of the conjunctiva gradually subsided, and the membrane on the conjunctiva in both eyes disappeared. In the latter part of September, there was a recurrence of conjunctival redness, membrane formation on upper and lower lids, and moderate swelling of the upper lid with free discharge. No vesicles were seen in either cornea.

The patient had no fever and no constitutional symptoms. Sulfadiazine was given internally, and sulfathiazole ointment was used in the eyes. Fowler's solution was administered by mouth in doses varying from 3 to 6 drops, three times daily. Repeated smallpox vaccinations were performed. A strict, saltless diet was instituted.

Ocular inflammation again subsided. The patient now presented only erosive areas on the inner surfaces of the lips and on the buccal mucosa.

Discussion. Dr. George S. Dublin said that it has been his good fortune to be able to see this case from its beginning. When first seen, there was noted a severe inflammation of the conjunctiva. A distinct membrane was present on the tarsal conjunctiva of the lids. This membrane, yellowish in color, appeared to be on the surface of the conjunctival epithelium and did not appear to involve the deeper layers. He had tried to remove part of the membrane but was unsuccessful. About two or three days later, a membrane appeared on the bulbar conjunctiva both temporally and nasally, paralleling the limbal border, in one eye extending to the

outer canthus. In addition, there was a profuse ropy discharge.

Dr. Klauder's earlier findings of vesicular formation in the skin together with a stomatitis pointed to a possible pemphigus. Mild lotions were prescribed, and the condition cleared to a remarkable degree in approximately 7 to 10 days, at which time the membrane completely disappeared in both eyes.

The patient volunteered the information that as soon as the eyes would become well, the mouth would break out into various sores. She was right. This condition in and about the mouth lasted four or five days, and then there was a recurrence of the ocular symptoms, and each time the membrane was more extensive than during the previous flare-up. Dr. Dublin said that he did not know how to treat the condition, since there seemed to be no adequate therapy. He had never seen a case with such an extensive membrane formation. There are other conditions simulating pemphigus; such as, erythema multiforme, dermatitis herpetiformis, and bullous syphilid. There are still other conditions which will produce membranes, both of the pseudo type and of the deep type of membranous conjunctivitis.

As we know, membranous conjunctivitis involves the deep portion of the epithelium or submucous portion and is invariably considered to be due to diphtheria. This patient was not acutely ill, nor was there any rise of temperature. As no diphtheria bacilli were found, the possibility of diphtheria was eliminated. A culture and smear were taken, but the bacteriologist was unable to identify the organism, stating that it was a very rare gram-positive bacillus.

The patient had two more flare-ups associated with new lesions in the mouth. No special treatment was ordered, since the condition would clear up under simple, bland medication. The patient, however,

received sulfanilamide, internally, in doses of 60 gr., daily, for approximately 10 days. The disappearance of the membranes, Dr. Dublin believed, was not due to the sulfanilamide, because they cleared up without it after previous attacks. When the patient was last seen all the lesions and membranes had entirely disappeared. It is significant that the cornea was at no time involved. There were no vesicles, nor any ulcer formation. The conjunctivas, both tarsal and bulbar, in spite of the dense membrane which was present, at no time showed any bleeding or ulcerated areas, or areas of adhesion. The vision at all times was 20/20 in each eye.

Pemphigus is a rare disease. It may assume an acute or chronic form. The acute form, occurring chiefly in butchers, is a virulent type, with marked constitutional symptoms, and frequently causes death. Chronic pemphigus is frequently called essential shrinkage of the conjunctiva. The cause is unknown, but it is associated with bullae in the skin and mucous membranes in various parts of the body. In the eye, vesicles are rarely seen in the conjunctiva. In their place, however, are small reddened areas, probably the end result of broken bullae. This condition is frequently incorrectly diagnosed or, at least, a proper diagnosis is not made until the late stages, when shrinkage of the conjunctiva takes place. The shrinkage of the conjunctiva is due to connective-tissue formation in the submucous portions of the conjunctiva. When this occurs, there is thickening of the conjunctiva with symblepharon formation and, eventually, ankyloblepharon.

Slitlamp examination in the late stages usually reveals perivascular thickening along the vascular network, together with a parchmentlike appearance of the conjunctiva. Vesicles in the cornea are seldom observed, but corneal changes do

occur secondary to the conjunctival pathologic alteration. The diagnosis is made generally by a dermatologist on the finding of bullae and vesicles in the skin and in the mucous membranes of the body, especially the mouth, larynx, nose, and rectum. A pseudomembranous formation with a chronic type of conjunctivitis is sometimes seen. The membrane affects both the tarsal and bulbar conjunctivas, in contrast to the true pseudomembrane which affects only the tarsal conjunctiva.

In the case presented by Drs. Klauder and Cowan, vesicles were noted in the skin and in the mucous membrane of the mouth, with a history of numerous exacerbations. The eye findings consisted of a membranous conjunctivitis, with numerous flare-ups, and with complete disappearance of this membrane in 7 to 10 days. Although the conjunctiva has shown no permanent defect, in all probability there will be alterations of the conjunctiva. Time alone will confirm or disprove the diagnosis of pemphigus in the case.

Dr. William Lamotte said that, Dr. Klauder had stated that there is no laboratory test for pemphigus. There is reported in the literature, however, a so-called Macht test with which he was not familiar. He asked Dr. Klauder to describe this test and tell whether or not it had any value.

Dr. W. E. Fry suggested that another differential diagnosis may at times, have to be considered; namely, the difference between a vernal conjunctivitis and pemphigus. He mentioned this because of a case that had come under his observation about a year and one half earlier. The patient was seen by Dr. Klauder—a young woman who gave the history of having multiple lesions of the gums, which necessitated the removal of all of her teeth. Exactly what the lesions were was not known.

When this patient was first seen, the

ocular condition was that of papilloma formation over the palpebral conjunctiva. The symptom of which she complained was intense itching. This led to the belief that the condition was vernal conjunctivitis. Smears showed an enormous number of eosinophiles. There were numerous nodules. A biopsy specimen of one of them showed the tissue to be similar to that from cases clinically diagnosed as vernal conjunctivitis.

Dr. Klauder saw the patient, found evidence in the mucosa of previous lesions, and believed that the patient had pemphigus. The patient has since died. Except that it was not an accident, the exact cause of her death was not known. Presumably, however, Dr. Klauder's diagnosis of pemphigus is correct.

Dr. Warren S. Reese said that he would like to ask Dr. Klauder whether, in his experience, cases of ocular pemphigus usually show skin lesions?

Dr. Joseph V. Klauder answered Dr. Lamotte by stating that he did not think the Pels-Macht test an infallible means of diagnosing pemphigus. False positive reactions are obtained, and the consensus of opinion is that it is unreliable.

He could not, offhand, give the percentage of patients with ocular pemphigus in which the disease exists without involvement of other mucous surfaces and without skin lesions. It may occur without other lesions. It may occur with mucous-membrane lesions, and it may occur with mucous-membrane lesions and skin lesions. In answer to Dr. Reese's question, however, he believes that only in the minority of patients is the disease confined to the conjunctiva. He estimated this minority to be about 25 percent. The literature is quoted to this effect in his paper with Dr. Cowan, "Ocular pemphigus and its relation to pemphigus of the skin and mucous membranes." (Amer.

Jour. Ophth., 1942, v. 25, June, pp. 643-66.)

HERPES ZOSTER OPHTHALMICUS APPEARING AFTER TRAUMA

DR. JOSEPH V. KLAUDER (by invitation) reported seven cases of herpes zoster, appearing after injury to the skin or to the cornea, inflicted in various ways and of variable degree. The disease appeared in the region of injury after an interval varying from about one to nine days. In some of the patients, symptoms of sensory disturbance or pain intervened between injury and outbreak of herpes zoster.

Of the seven patients, four had herpes zoster ophthalmicus. The injuries preceding appearance of herpes zoster ophthalmicus were: (1) foreign body in the cornea; (2) contact of the eye and forehead with sulphur dioxide; (3) bumping one side of head on a hard object without producing demonstrable injury to the skin, in two patients.

Review of the literature disclosed many reports of herpes zoster appearing in from 1 to 30 days after injury, at times trivial, to the skin or cornea. Herpes zoster had also been reported as appearing after lumbar puncture, after intramuscular injection of a medicament, after osteopathic manipulation of the spine, and after deep X-ray therapy in the region of a ganglion.

The etiologic mechanism of herpes zoster appearing after trauma was discussed. The incubation period of spontaneously occurring herpes zoster and of the disease when experimentally produced was discussed.

From considerations discussed, it was reasonable to assume that trauma may precipitate herpes zoster. The minimum degree of trauma and the interval between trauma and the appearance of herpes

zoster, in order to ascribe to trauma a causal role, cannot precisely be defined. From experimental evidence and clinical observation of spontaneously occurring zoster, the incubation period of the disease ranges from a few days to about two weeks. From the cases now reported of zoster appearing after trauma, and from a review of the literature, the intervals which predominate are one day to about three weeks.

Dr. Walter Lillie said that Dr. Klauder's presentation interested him, inasmuch as the cases he had reported concerning the use of smallpox vaccine in the treatment of herpes zoster ophthalmicus had no history of trauma. Since Dr. Klauder's cases show such a great variation in the time of onset after trauma (less than a day to six weeks), a real doubt can be raised as to the importance of the trauma. It is well known that it is not difficult to elicit trauma in almost any history of any type of condition. He recalled one case seen at the Mayo Clinic in which a patient, with blindness in one eye and a very small field of vision remaining in the other due to a pituitary tumor, received \$2,500 when the court agreed that the visual loss resulted from a pair of pliers striking his forehead. It is agreed that herpes zoster is a virus disease, that belongs to the chickenpox family, having a definite incubation period of at least a week or more. This explains why many times herpes zoster and chickenpox can be found in the same family.

Dr. George F. J. Kelly said that, at the present time, he had under his care a patient with herpes zoster ophthalmicus. According to her statement, five days previous to the appearance of the lesion some hot lard had splashed on the involved area. He felt this to be coincidental and not causative.

Dr. Joseph V. Klauder replied that ex-

periments made to ascertain if zoster is caused by a virus have given conflicting results. The opinion is stated by some that it has not been conclusively shown that zoster is caused by a virus and that the disease may represent a syndrome resulting from any process causing inflammation of the spinal ganglion. Others accept experimental evidence as valid proof of virus causation and regard the elementary bodies demonstrable in herpes zoster vesicles, particularly within the first 48 hours, as representing the specific virus of the disease. Proof of virus cause of zoster is not so readily demonstrated as is such proof of herpes simplex.

SURGICAL METHODS OF TREATING PARALYSIS OF THE SUPERIOR OBLIQUE MUSCLE

DR. WILLIAM E. KREWSON, III, said that isolated, unilateral paralysis of the superior oblique is frequently encountered; bilateral involvement, occasionally. The pathologic physiology of ocular movements of such cases was reviewed.

The literature records relatively few cases treated surgically, and for these a great variety of procedures has been offered. At some time or other, most muscles attached to each eye have been used in one way or another. These include: (1) weakening of the homolateral superior rectus; (2) advancement of the homolateral inferior rectus; (3) advancement or transplantation of the homolateral external rectus; (4) weakening of the contralateral inferior rectus; (5) tenotomy or recession of the homolateral inferior oblique; (6) shortening of the contralateral superior rectus; (7) advancement of the paralytic superior oblique; (8) various combinations of two or more of these operations.

No standard sequence of corrective measures can be advocated for all cases. The plan of attack must be based on

measurements found in each individual case. If a choice is permitted, weakening of a depressor muscle is undesirable; strengthening of a depressor or weakening of an elevator is preferable. In bilateral cases, equalization and preservation of the remaining depressors is advisable.

Discussion. Dr. Francis Adler said that he would like to amplify one of the factors which Dr. Krewson mentioned, a factor which occasionally leads to an erroneous diagnosis of these cases. He believed that this condition was first pointed out by Chavasse, under the term "inhibitional palsy of the contralateral antagonist." It is seen in those cases in which fixation is customarily carried out by an eye with a paralyzed superior oblique. In these cases, there is not only a characteristic limitation of movement downward and to the side opposite the paralyzed superior oblique, but there is also limitation of movement of the non-paralyzed eye on looking up to the ipsilateral side. For example: In a case of paralysis of the left superior oblique, the left eye fails to move down when the eyes are turned down and to the right. In such a case, the right eye fails to move up when the eyes are turned up and to the right. This may easily be mistaken for a paralysis of the right superior rectus muscle. Dr. Adler believed that the explanation for this so-called inhibitional palsy is somewhat similar to the explanation of the vertical separation on looking down and to the right when the left superior oblique is paralyzed. The vertical separation on looking down to the right is due to two factors: (1) the weakness in the left superior oblique muscle; (2) the overaction of the right superior rectus. This overaction is due to the well-known law of Hering, that all voluntary movements are brought about by an equal innervation to the muscles of the

two sides concerned in the movement. When we look down and to the right an equal innervation is sent to all of the muscles of the two sides which carry the eye in this direction. When one of these muscles is weak, the total amount of innervation is increased so as to bring about the full movement of this weak muscle, but the same amount of innervation is sent to the yoke muscle of the opposite side and so this muscle overacts.

On looking up and to the right, in a case of left superior oblique paralysis, when the left eye is fixating, the movement in this direction is made easier if the left superior oblique is paralyzed, because the left inferior oblique now has no resistance from its opponent. Less energy will be required therefore, to turn this eye out, up, and to the right; accordingly, less innervation is sent to the yoke muscle of the left inferior oblique—namely, the right superior rectus—and this eye fails to move up as far as the left.

Dr. Glen G. Gibson said that he had had experience with mistaken cases of superior-oblique palsy. One of the common types of cases in which the diagnosis may be incorrect are those simulating convergent strabismus. These were cases of palsy which started out primarily as a superior-oblique condition but, as time passed, they became concomitant, and it was almost impossible to differentiate them from cases of ordinary accommodative-convergent strabismus. In some of these, he at first failed to recognize their vertical origin and had operated as if they were cases of convergent squint, only to have them return with unsatisfactory results. Further study would then reveal that they were originally trochlear cases. A second operation produced gratifying results, because the surgical procedure recognized the primary pathologic involvement. Dr. Krewson believed that careful atten-

tion to the sensory correspondence was helpful in selecting the proper type and amount of surgical correction.

He illustrated the simplest operation by presenting a traumatic case of trochlear palsy of a year's duration in which there was 21 prism diopters of hyperphoria. This patient was subjected to a recession of the inferior rectus of the opposite eye. Following the operation, which consisted of a 2-mm. recession of the contralateral inferior rectus, there was no hyperphoria. In other words, the 21 prism diopters of hyperphoria had been reduced to zero by a minimal recession.

The important point in this case was not that it was an instance of very precise measurement of the amount of necessary surgical correction, but rather that a good surgical result was achieved because this patient originally had, and, until his accident, had always had, normal binocular vision. What was done was to put the eye somewhere near the normal place, and since the patient had normal binocular vision, the sensory mechanism helped to bring the eyes to the precise place where they were wanted.

If the case is long standing or congenital, a 2-mm. recession is not adequate for bringing about the desired result, particularly in cases that present a marked vertical tropia. In such cases it is necessary to do a recession of as much as 4 or 5 mm., about the maximum recession possible in the inferior rectus of the other eye. In some cases, especially those of long standing in adults, it is necessary to combine both the recession of the inferior rectus of one eye with a tenotomy of the inferior oblique of the other, or paralytic eye.

One other important point is the recognition of birth traumas and hereditary factors as a cause of trochlear paralysis. Recently two grandmothers, who have

had that condition all their lives, were seen. They were grandmothers of two patients on whom operations for trochlear paralysis had been performed. This shows a definite hereditary factor for which the ophthalmologist should look.

Birth trauma is a common cause. It is fruitful to investigate these cases, particularly for the history of forceps delivery as a possible cause of original trochlear palsy. It is also important to recognize the degree of binocular vision that these patients have. If the condition has been present from birth, the individual never did have binocular vision except with an abnormal position of the head. A much more extensive surgical procedure is needed in these cases than in those of traumatic origin.

GEORGE F. J. KELLY,
Clerk

COLORADO OPHTHALMOLOGICAL SOCIETY

October 20, 1945

DR. WALTER OMHART, *president*

CHOROIDITIS TREATED BY PENICILLIN

DR. GEORGE H. STINE presented H. H. P., a white woman aged 35 years, who had first been seen about five weeks previously. She gave a history of previous attacks of choroiditis. At this time she had a large, atrophic, healed area with a fresh patch of exudate nearby, accompanied by paraphlebitis. The lesions resembled tuberculosis, but the tuberculin tests were negative. There was considerable peridental infection. The condition had improved following dental extractions, and foreign protein, atropine, and penicillin therapy.

RETINAL DETACHMENT, MYOPIA, MULTIPLE HOLES

DR. GEORGE H. STINE presented Mr.

W. C. K., aged 50 years, whom he had first seen on June 12, 1945. The patient complained of having had blurred vision for several weeks. This became much worse after an automobile drive over a rough road. Interesting features of the case were the high myopia and the presence of three holes. One near the macula was treated by galvanism. After treatment with perforating and nonperforating diathermy in the peripheral-tear areas, the retina was almost entirely reattached. A second operation, treating the region of the peripheral tears, was performed on September 6, 1945. At this time the retina was completely reattached with corrected vision of 20/200 in the right eye. Dr. Stine said that after retinal-detachment operations, there is an exaggeration of normal phenomenon; that the periphery is seen with more plus than the macula. This was illustrated in this case in that the macula was best seen with a minus 11 sphere whereas the peripheral-tear areas were seen with a plus two sphere.

RETINAL DETACHMENT, MULTIPLE OPERATIONS, POSTERIOR SCLEROTOMY

DR. GEORGE H. STINE presented Mrs. C. W. G., aged 67 years, who had been seen in 1931 and 1934 because of vitreous opacities. On June 18, 1934, a retinal detachment was found in the upper nasal quadrant of the left eye by Dr. Neeper. Pinhole glasses were prescribed, and the retina reattached by July 8, 1934. The detachment recurred on July 24th. It was larger than the previous one, but improved after bed rest and dental extractions. Surgery was performed in the upper nasal quadrant by Dr. Clifford Walker on August 13, 1934. The patient was operated on again by Dr. Stine on August 27, 1934. At this time a posterior sclerotomy was done in the lower nasal quadrant.

A tear then developed in this area which Dr. Stine attributed to the posterior sclerotomy. A third operation was performed by Drs. Walker and Stine in the upper and lower nasal quadrants on September 17, 1934. The retina reattached 10 days later. At the time of presentation of the patient (11 years later), there were some drusenlike opacities in the macula, a few vitreous opacities, and a small posterior capsular cataract. Slit-lamp and plano-contact-lens examination showed marked forward contraction and shrinkage in each eye. The retina of the left eye was still in place, and the corrected vision was 20/30.

OSTEOMA OF THE ORBIT

DR. K. H. CHAPMAN presented G. R., a boy aged four years, who had had a swelling at the outer canthus just inside the lids since birth. When he was one year old, the swelling had been "opened" by an ophthalmologist, but the size had remained the same. On examination, Dr. Chapman found a narrow band of scar tissue in the conjunctiva extending from the outer posterior canthus for about 5 mm. Posteriorly and temporally to this was some fullness, but no definite mass could be palpated. The preoperative diagnosis was "accessory lacrimal gland which had become cystic."

While the child was under a general anesthetic for a tonsillectomy, a mass was dissected from the orbit just posterior to the lateral orbital margin, to which it was not connected. It was a firm, lobulated, freely movable, well-encapsulated mass about 2 by 1½ by 1 cm. in size and similar in appearance to a lacrimal gland. The pathologic diagnosis, however, was "osteoma." Dr. Chapman said that osteomas, invading the orbit from the sinuses, are relatively common, but that she had found no recent reports of one in the

temporal orbit unconnected with the orbital wall.

MICROPHTHALMOS, HARELIP, AND CLEFT PALATE

DR. GEORGE H. STINE showed a kodachrome picture of an infant born with a major cranial deformity and other associated malformations including bilateral microphthalmia.

Discussion. Dr. William H. Crisp mentioned a case of microphthalmia associated with marked corectopia.

Another member said that he had recently seen a child with microphthalmia associated with a white congenital abnormality in the vitreous. In discussing the differential diagnosis, the question was asked whether any member present recalled ever having seen a case of retinoblastoma in one of these small eyes. No one remembered having seen such a case.

ACUTE GLAUCOMA, PARACENTESIS

DR. WILLIAM BANE reported the case of an elderly lady who had had an attack of acute glaucoma which had not responded to miotics. He had then performed a paracentesis, and the tension had immediately come down to normal and had remained so with a minimum of medication.

Discussion. Dr. William H. Crisp said that in some of these paracenteses and in Curran's operation we, in essence, had a small iridencleisis.

CATARACT, RECURRENT IRITIS, AND DEAFNESS SECONDARY TO INJURY BY LIGHTNING

DR. V. H. BROBECK and CAPT. C. A. FLEISCHLI presented G. W., a 22-year-old pilot of a B29 bomber, who had been struck by lightning four months previous-

ly, just as he had stepped out of his plane. He was unconscious for 36 hours but had made a complete recovery except for deafness in his right ear, diminished vision in both eyes, and recurring attacks of iritis. The poor vision was first noticed about a month after the accident, and examination revealed the cause to be capsular cataracts. Two months following the injury, the vision had been reduced to 20/50 in the right eye and 20/40 in the left. There had been no further loss of vision nor progress in the opacities since then. No foci of infection were found to account for the recurrent iritis. Dr. Brobeck said it was interesting to speculate on the manner in which the iritis was caused by the lightning. The iritis had responded to cycloplegics and foreign protein. An interesting feature of the case was the fact that the lightning had burned the amalgam fillings out of his teeth. The patient has an amnesia for events just prior to the injury.

Discussion. Dr. George H. Stine mentioned that in a family of three which was struck by lightning, two of the members developed cataracts and one was not affected.

Dr. R. W. Danielson said that the interval before developing cataracts was similar to that in dinitrophenol cataracts. In both cases the cataracts are probably secondary to the effect on the germinal epithelium of the lens.

Drs. W. A. Ohmart, J. W. Lamme, and E. R. Neepier also reported having seen cases of cataract secondary to injury by lightning.

TUMOR ON THE DISC

DR. FRITZ NELSON presented J. E. W., a white man, aged 61 years, who said that about five years before, the vision of his left eye had deteriorated somewhat due to a fundus lesion of uncertain ori-

gin. The vision of the right eye had always been good. About $2\frac{1}{2}$ years later, a little node began growing slowly below the left lower jaw bone. He was sent to the cancer clinic and received about 25 X-ray treatments to the left side of the naso-pharynx, whence the primary tumor had supposedly originated. The tumor below the jaw was not treated.

The patient was first seen by Dr. Nelson on January 26, 1945. At that time the tumor below the jaw was about the size of a hen's egg, very firm, and not attached to the skin and deeper layers. There was no dislocation nor exophthalmos (Hertel, 18 mm.) of either eye. The corrected vision of the right eye was $5/3$ and of the left $5/6$. Ophthalmoscopically, the right eye had a white prominence (about $2\frac{1}{2}D.$) at the lower edge of the disc, which was partly covered by it. The formation resembled a bundle of medullated nerve fibers, but seemed to be globular in shape and more prominent than one would expect.

Dr. Nelson was suspicious of a metastatic tumor on the right optic disc. The probable general diagnosis was: "a slow-growing malignant tumor (sarcoma or mixed tumor) of the left, submaxillary salivary gland. The condition had not shown much change during the past nine months. Dr. Nelson planned a biopsy of the tumor below the left mandible.

Discussion. Drs. William M. Bane and George H. Stine and others believed the tumor was composed of medullated nerve fibers in spite of the elevation.

MALIGNANT MELANOMA OF IRIS AND CILIARY BODY

DR. FRITZ NELSON presented P. B., a white man aged 51 years. The patient was first examined in the fall of 1941, and neither eye showed any abnormality. In October, 1944, during a routine refraction, a small dark chocolate-brown fusi-

form tumor was found between the 7:30 and 8:30 positions, involving the root of the iris of the right eye. This tumor was about 3 mm. long and not quite 1 mm. wide. All functions of that eye, including the field of vision and visual acuity, were normal. Malignant melanoma of the ciliary body was suspected at that time, but no protrusion of a tumor from the ciliary body backward could be seen.

On April 4, 1945, the patient was re-examined. The tumor of the iris was of about the same size, but now protrusion from that region into the vitreous body could be seen ophthalmoscopically. The size of the tumor in the ciliary body was that of a very small pea. Because of the early stage, it was planned to destroy the tumor with a diathermic needle. The patient, following the advice of another ophthalmologist who told him that the eye was perfectly normal, refused treatment.

He was seen again on October 20, 1945, and a definite increase of the tumor could be seen ophthalmoscopically. The tumor was surrounded by a translucent or semi-opaque zone, and the equator of the lens showed a small opacity probably caused by some influence from the tumor. Dr. Nelson thought that enucleation of that eye was now probably the only choice.

Discussion. Dr. George H. Stine advised a diagnostic iridectomy, examination of a frozen section and removal of the eye if the tissue showed malignancy.

Dr. R. W. Danielson said that the presence of the opacity in the lens was confusing. He recalled a case in his practice in which, with an undilated pupil an opacity of the periphery of the lens had ophthalmoscopically given the appearance of a tumor in the ciliary body.

RALPH DANIELSON,
Acting Secretary.

LOS ANGELES SOCIETY FOR OPHTHALMOLOGY AND OTOLARYNGOLOGY

SECTION ON OPHTHALMOLOGY

October 22, 1945

DR. K. C. BRANDENBURG, *presiding*

CLINICAL ASPECTS AND TREATMENT OF EXOPHTHALMOS FROM THE EXPERI- MENTAL VIEWPOINT

DR. HARRY FRIEDGOOD reviewed the anatomic and physiologic aspects of experimental exophthalmos in lower mammals and correlated them with the clinical picture of exophthalmos in man. He stated that it was possible to produce exophthalmos in experimental animals by means of anterior-pituitary injections much more easily after removal of the thyroid gland than before. Dr. Friedgood said that of the various possible explanations for the mechanism of exophthalmos due to thyroid disease, it seemed that edema of the orbital tissues was the most likely.

It was concluded by Dr. Friedgood that the exophthalmos of this syndrome goes through two phases, the reversible and irreversible. He said the former was ordinarily encountered in exophthalmic goiter. The latter, he said, occasionally occurs as a postthyroidectomy complication.

The evidence, he pointed out, suggested that an exophthalmos-producing (ophthalmotropic) factor in the pituitary gland, distinct from the thyrotropic hormone, induces both types of exophthalmos. The use of the word ophthalmotropic, he said, does not imply that a specific chemical substance having the physiologic action is believed to exist as such in the pituitary gland. Dr. Friedgood said that

because this factor is probably responsible for edema of the orbital tissues, it might be tied in with the important role which the pituitary and thyroid glands play in regulating water metabolism.

Although the irreversible or malignant type of exophthalmos cannot always be differentiated in advance from the benign or reversible type, certain clinical criteria aid in the diagnosis. Since edema of the orbit is probably an early pathologic change, one should regard with suspicion any preoperative chemosis, lacrimation, puffiness, or venous congestion of the lids or orbit. The development of hyperthyroidism during iodine therapy or the presence of thyrotropic hormones in the urine should put one on guard, according to Dr. Friedgood, as should a low basal-metabolism rate and increase in blood cholesterol.

He also stated that males with slight hyperthyroidism and considerable exophthalmos are peculiarly predisposed to the development of malignant exophthalmos following thyroidectomy. In his opinion operation should be avoided in suspicious cases or, if operation is necessary, the pre- and postoperative administration of desiccated thyroid may prevent the development of hypothyroidism, which is known to favor the development of malignant exophthalmos.

NEUROTICISM AMONG ANISEIKONIA PATIENTS

DR. K. C. BRANDENBURG, in collaboration with his associate, Dr. Hazel Wentworth, made a preliminary report on a study of the neurotic factor among aniseikonia patients (utilizing the Harrower-Erickson modification of the Rorschach test). They had divided a series of 50 patients into three groups and scored them according to their percentage of poor

answers on the Harrower-Erickson multiple-choice test as follows:

	<i>Number Cases</i>	<i>Median Score*</i>	<i>Average Score* percent percent</i>
Group I			
No symptoms—no aniseikonic test	7	6.5	12
Group II			
Symptoms—1% or more aniseikonia			
A. Marked or complete relief	23	11	15
B. Partial relief	9	23	21
C. No, or only slight	10	40	39
Group III			
Symptoms—No aniseikonia or less than 1%	11	20	27

* Scoring of H-E Rorschach: 0 percent—no poor answers; 100 percent—all poor answers; under 40 percent—normal; 40 to 50 percent—borderline; over 50 percent—disturbed personality.

Dr. Brandenburg called attention to the limited number of cases tested in each group, rendering the reliability of the results somewhat questionable. He also pointed out that the averages for all groups fell within what was considered the normal range of bad answers.

There was, however, a definitely greater average of bad answers among aniseikonia patients who received no, or only slight, relief from their correction (39 percent) than among those who received complete relief (15 percent), or only partial relief (21 percent). Whether the

percentage of bad answers within the normal range could be considered a criterion of a degree of neuroticism had not been established experimentally as far as the essayists were aware. Dr. Brandenburg reported that the figures seemed, however, to corroborate the clinical impression that when aniseikonia exists in an individual who does not manifest marked neurotic tendencies, isekonic lenses are more likely to give lasting relief than in cases wherein the neurotic factor is of greater importance. He stated that the study would continue.

PSYCHOLOGIC PROBLEMS OF IMPENDING BLINDNESS

MR. J. MILTON JOHNSON of the Braille Institute stressed the psychologic importance of acquainting persons with impending blindness with the many activities, useful and diverting, which are available to the blind. He thought it to be desirable that they learn these things from someone who was, or had been, blind and could therefore understand the hopes and fears of one whose vision was failing or had failed. He described the various activities of the Braille Institute of America and asked the coöperation of the eye specialists in making these contacts possible.

C. H. Albaugh,
Reporter.

AMERICAN JOURNAL OF OPHTHALMOLOGY

Published Monthly by the Ophthalmic Publishing Company

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FEDERAL INVESTIGATION OF REBATING

In a Saint Louis newspaper of July 24th appeared this headline: "Anti-Trust Suits Charge Rebating to Eye Doctors" and, in a subheading, "Civil Actions name Seven Concerns, about 5,000 Individuals, and ask for Injunctions."

I quote the first paragraph of the article: "The Department of Justice today filed two civil suits in Federal Court charging optical wholesalers and approximately 5,000 leading eye doctors through-

out the country with violating anti-trust statutes." Thirty eye doctors were named in "a representative capacity" representing 3,000 doctors who are accused of receiving rebates regularly from one company. Another company is accused of rebating through its subsidiaries to another 3,000 eye doctors. Allowing for some overlapping, probably 5,000 eye doctors are involved directly or indirectly in the suit. There are about 7,500 ophthalmologists in the nation. Approximately two thirds are, therefore, accused.

Since writing these introductory paragraphs, there have appeared copies of the indictments in the Journal of the American Medical Association and an editorial in the same issue which merely stated the resolutions passed previously by the Ophthalmic Section and the action of the House of Delegates on these resolutions.

In other newspapers, in addition to the names of the representatives in the two indictments, there apparently appeared the names with the amounts allegedly rebated to some of the ophthalmologists.

The writer has always strongly contended that it is ethically wrong to take a hidden fee from a patient and that an ophthalmologist should not profit in any direct financial way from the sale of lenses or their appurtenances. This is the rule of ethics of the American Medical Association, but it has admittedly been disregarded by many members of its official Eye Section.

In discussions of the matter, one often encounters the comment "Granted that the practice is current, surely you don't want the public to lose confidence in the eye doctor by letting people know about it." The answer is that no one should have the public confidence if he does not deserve it. One usually then hears the statement that those in the eye specialty are not alone guilty, that rebates are taken on orthopedic appliances, ear phones, drugs, and other items, so why should ophthalmologists be singled out for punishment. Obviously, everyone who engages in such practices should be called to account, but unethical conduct in one person is not a good excuse for it in another, and it is the ophthalmologists' misfortune that they have been selected for action.

What a perfect opportunity this well-known practice has given to those whom ophthalmologists have attacked on ethical and moral grounds to say

"Look who are calling the kettle black."

Unfortunately, we could not or, at any rate, would not handle this matter within our own profession so now the Federal Government has taken the task over.

Whether doctors who accept rebates are legally liable or not is not for the writer to say. If the doctor has failed to show in his income tax report any money received, that is another story and no lawyer is needed to answer that question, and the eye physician would better engage a good one to defend him. The rebater has surely had the transactions on his books and, undoubtedly, the Government has already secured these books containing the lists of names and amounts rebated.

It would probably be desirable for the profession to know everything about these matters. The writer guesses that, unfortunately, there are some in very high places whose names are on these lists. Whether it would have a salutary effect or not for everyone to know the names of those who engage in these doubtful practices is a moot question. Frankly, the writer would not enjoy seeing them exposed before their friends and patients. Actually, some of this may never happen but the indictments bring up once more this disagreeable problem that has thus far baffled all who have tried to eliminate it. Medical disciplinary action in this matter must of necessity fall upon the American Medical Association because the Ophthalmic Section has no authority to handle it. By the nature of the Constitution of the American Medical Association, ultimate discretion in regard to ethics rests with the county medical societies, and the Ethics Committee of the House of Delegates, if it takes any action at all, will probably refer the matter to these hundreds of county organizations, possibly after a few generalities on the subject. It is not necessary to comment on the complete lack of action that

would be taken by most of the local medical societies.

But is not there anything that can be done to eliminate these unwholesome practices that cast opprobrium on all physicians and furnish good grounds for the Government's lack of faith in the ability of the medical profession to act in the best interest of the public? The Government apparently is now fully aware of the existence of rebating and believes it is illegal and harmful to its citizens. We must agree that it contributes to increase the cost of glasses and that in itself is detrimental to the general welfare. Wholesalers and retailers alike must surely want the practice stopped. It does them no good and is financially harmful.

The writer suggests that the Executive Committee of the Section on Ophthalmology of the American Medical Association appoint a committee to confer with Government agents, wholesalers of optical goods, and representative retailers for a frank discussion and an effort to adopt a course to bring about a termination of this abuse. The Government may frighten some out of rebating and receiving rebates, but the coöperation of all of those interested in the matter might prove even more effective than the governmental warning and fining of a few individuals selected to be the scapegoats for other possible offenders.

National and local ophthalmic societies and The American Board of Ophthalmology have no police powers and should not have, their functions are other than this, but a stronger attitude by them on "kick-backs" and rebates would be helpful in stamping out this pernicious practice and would more definitely indicate to the young men entering our specialty our wholehearted disapproval of it.

Lawrence T. Post.

A STANDARDIZED CURRICULUM

The need for more graduate courses in ophthalmology is as acute as it is obvious. The number of applicants for such training is tremendous. The reason for the large number is not difficult to find. Many physicians, while serving in the Armed Forces, were brought into contact with ophthalmology, usually under the guidance of a well-trained, older man. The result is that they would like to choose it for their own specialty.

The interest thus stimulated is no idle one, no passing fancy, but rather it is deep and sincere. The ultimate goal of the large majority is certification by the American Board of Ophthalmology. This is gratifying and is as it should be. One has but to interview these men to be convinced of their sincerity and singleness of purpose.

The available graduate courses in ophthalmology are few. These few are probably satisfactory, but no doubt there is room for improvement. Each course has its strong points, depending upon the interests of its faculty; similarly, each course has its weak points and for the same reason. It behooves us to take stock of our courses, to examine critically their curricula. How well are they preparing candidates for the examination of the American Board of Ophthalmology and, what is more important, for the clinical practice of good, sound ophthalmology? It would be wise to look for weak spots, for they are surely there.

It would be wiser still to have a "stranger" or even a board of strangers examine our curricula than to do it ourselves. It is objective, constructive criticism that is desired. The fresher viewpoint of an outsider would be invaluable.

Such a board might be formed under the auspices of the American Board of Ophthalmology or by any one or all of the

three national ophthalmic organizations. Its function would be to analyze the curricula of available courses with the view of taking the best from each and developing a standardized program for such courses. Just as the American Medical Association inspects medical schools in this country, so should such a board inspect graduate courses in ophthalmology. Our courses are probably good, but they could be made better.

One value of such a standardized curriculum, bearing the Board's stamp of approval, would be that it could be made available to many institutions to serve as a guide for the establishment of more courses. It seems probable that many large institutions have a wealth of clinical material at hand and also a faculty. All that they need is a blueprint in the form of a detailed, standardized, approved curriculum and a little encouragement.

At the moment, those conducting the available graduate courses in ophthalmology are on their toes. They should be kept that way. And other such courses should be initiated. The demand of large numbers of applicants makes it imperative.

Richard G. Scobee.

CENTENARY OF ANESTHESIA

On October 16, 1846, Morton dramatically introduced general anesthesia to the operating theater. The eminent and humanitarian surgeon, John C. Warren, with a courage reminiscent of Joseph Warren, his uncle, who fell at Bunker Hill, risked his great reputation in this hazardous experiment. The patient was Gilbert Abbott, a painter and single.

As now the atom holds the spotlight, so, in the early 19th century, gases and vapors dominated scientific attention. Beddoes became mystically inspired by their possible therapeutic value and, in his

Pneumatic Institute, Davy, in 1800, and Faraday, in 1818, discovered the insensibility produced by nitrous oxide and ether, respectively. These observations excited a minimum of attention. Even as later as 1831, Velpeau pontifically dismissed the hope of ever operating without pain. By 1839, however, the *Materia Medica* mentioned that ether could produce stupefaction. Then Long, at the age of 26, Morton at 27, and Wells at 29—obscure young men ignorant of Velpeau's dictum—demonstrated its fallacy. The concept of "anesthesia" now had a footing, and Oliver Wendell Holmes supplied the word.

But not all were convinced. Wrote Thomas E. Bond of Baltimore in the *Boston Medical and Surgical Journal* of December 15, 1846: "What your correspondents are pleased to call 'producing insensibility' is, in fact, making people 'dead drunk.' . . . Now, doctor, if we are to induce insensibility by this class of means, I very much prefer whiskey-punch to ether, because it is more certain and more permanent in its effects. It is less dangerous, and, lastly, it will be easier to persuade patients to take it."

Before the advent of local anesthesia in 1884, eye surgeons faced the choice of operating under general anesthesia or none and not infrequently decided that the advantages were with the latter alternative. William Mackenzie, in 1854, advocated general anesthesia for children, and for discussion on timid adults. But he continued: "In extraction I have not ventured to use it, being afraid lest the vomiting which is apt to follow might cause rupture of the internal structures of the eye. I have read, however, from others who have used it in extraction, a very favorable account of the complete stillness of the eye which it affords." Henry S. Schell of Wills Eye Hospital, in 1881, expressed the same viewpoint: "If the

patient is of steady nerve, and can be relied on to obey orders promptly, it will be more satisfactory to both parties to dispense with ether. . . . The pain of the incision is not very great, and slight pauses, with closed lids, may be allowed between the steps of the operation." But B. J. Jeffries of the Massachusetts Charitable Eye and Ear Infirmary, in 1871, declared otherwise: "In these days of ether and chloroform, one or the other is always administered, so that the patient suffers no pain, and after the operation is often unable to say which eye was operated on."

Intravenous anesthesia was widely used during the late war in the expeditious surgery of eye casualties only just evacuated from battle, and it proved a priceless boon to the tense, exhausted warriors. Because of its effectiveness and relative simplicity, this latest development of general anesthesia certainly merits wider acceptance for the eye surgery of everyday civilian practice.

James E. Lebensohn.

WETTING AGENTS AND DETERGENTS

References to the use of wetting agents and detergents in ophthalmic drugs became fairly common in 1941 and 1942. There is experimental evidence that important and desirable effects are sometimes produced by addition of specific surface-active agents to certain therapeutic preparations. These effects are: (1) increased solubility permitting higher concentration of therapeutic drugs to come into contact with the eye; (2) increased penetration into the cornea and other ocular tissues; (3) longer persistence of the therapeutic substance in the conjunctival sac in spite of dilution of the drug with tears.

The second of these effects is the one for which the most experimental data have

been presented, but the *modus operandi* is not explained to the satisfaction of the average clinical ophthalmologist. The benefit of using wetting agents or detergents is based on theoretical assumptions as to their action which, to the practical man, is discounted by certain evidence that the desired effects may be produced mainly by damage to the corneal epithelium.

The purpose of this editorial is to discuss the theoretical considerations involved in the use of wetting agents; to attempt to clarify "lowering of surface tension," which is the explanation most frequently encountered; and to review, briefly, evidence of damage to the corneal epithelium.

Because many of the recently introduced synthetic detergents combine properties of wetting agents and detergents in a single molecule, there has been a tendency to neglect any consideration as to whether the specific agent is chosen for its wetting power or detergency. Although knowledge in the realm of wetting agents and detergents is still rather limited, some consideration of the distinctive properties of each might help us to predict the type needed for a specific purpose.

Most detergents are wetting agents, but the very best wetters are not always detergents. A detergent must have wetting properties so that the soil or contamination on the surface will be completely wetted, that is, covered with fluid, whereupon the distinctive property of the detergent comes into play. The detergent lowers interfacial tension between soil and solution and lifts globules of soil off the surface, keeping them in solution or suspension so that they are not redeposited. The lifting of the particles off the surface into the solution is the distinctive action of the detergent. This may be accomplished through surface-action effects, influence on solubility, and by frothing or agitation. Usually, it is accomplished by a

combination of two or more of these factors.

The cleaning of a surface by a detergent can be readily appreciated as important in bringing therapeutic agents into truer contact with the absorbing surface, as, in the case of the cornea, by removal of exudate and detritus from the corneal surface, allowing uniform distribution of the solution over the entire surface. We have all observed how dew occurs as spherical drops of water on the surface of a leaf. Between the drops there is an exposed dry surface. The exposed surface will always have on it dust, insecticide powder, or other finely divided substances of some sort. In a heavy shower, all the dust is washed off, and the remaining water no longer forms drops but wets the whole leaf and forms a thin layer over the whole surface.

A wetting agent, like a detergent, lowers interfacial tension so that there is wetting with spreading of the fluid over the surface, but it does not necessarily clean the surface. It may leave the contaminating particles still adherent to or, in spreading, wash them onto another part of the surface.

How does a wetting agent induce a solution to spread over and penetrate into a surface?

We all know the theory that the molecules in any substance attract each other by electrical forces. We readily see that the attraction forces in the interior of a mass of liquid will be balanced in all directions but that, at the surface, there will be an uneven distribution of forces inward. The cohesive forces holding the substance together are not balanced at the surface, and there is a pull toward the interior exerted on the surface layers. To break this surface, it is necessary to do work, to exert force. Since this surface force is uniform, due to the averaging effect of the very large number of molecules per

unit of surface area, and since it tends to produce a surface with the smallest possible area, there results a spherical shape in any drop of liquid free from the effect of gravitational forces. The work required to overcome this surface force is called the surface tension.

Now, if there are two constituents of a solution and the molecules of one have a higher attractive field of force around them than the molecules of the other, and, if the molecules of higher attraction are present at the surface, a liquid with a comparatively high surface tension results. Contrariwise, if the molecules with the smaller fields of force are at the surface, the surface tension is smaller. Since the molecules are free to move, the liquid will always tend to cover itself with the molecules of the constituent possessing the smallest field of force. Consequently, we choose, as a wetting agent, a substance with low cohesive forces, and we cover the matrix fluid with a film of the wetting agent. Thus, we modify the surface tension of the fluid, lowering it so that it has less tendency to conglomerate and more tendency to spread.

If the attraction of the matrix liquid for molecules of the added substance is greater than their cohesive forces, the added liquid, or solid, will spread and, in so doing, the substance forms a film over the matrix liquid. If the cohesive forces are sufficiently weak, the added substance will spread uniformly over the surface. The action of a surface-active agent in wetting is, therefore, due to the repulsive forces which occur between molecules of the agent collected as a film on the surface of the main body of fluid. This repulsion resists the concentrating effect of the contraction forces existing on the surface layer of the main body of fluid. It is a repulsion that not only counteracts these contraction forces but also acts to push the matrix fluid into corners and over sur-

faces that would not ordinarily be wetted by this fluid. The surface-active effect depends on the molecules remaining as a film on the surface.

Langmuir, in 1917, introduced the ideas, still accepted, concerning the orientation of the molecule in these surface films. These ideas are discussed by Roth (*Amer. Jour. Ophth.*, 1946, v. 29, p. 717). To illustrate, for one group of substances: Molecules of fatty acids and alcohols contain the water-soluble, hydrophilic groups (OH and COOH) and water-insoluble, hydrophobic groups. The hydrophilic groups tend to solubilize the molecule. In the case of shorter chain molecules, as methyl and ethyl alcohols and acetic acid, these groups are sufficiently hydrophilic, unbalanced by hydrophobic groups, to solubilize the entire molecule and, therefore, leave no surface effect since the alcohol or acid is readily diffused beneath the surface of the matrix fluid. With an increase in length of the chain, the solubility decreases, and there is a balance of hydrophilic and hydrophobic groups tending to produce a molecular surface film. As we come to the very-long-chain fatty acids, the solubilizing effect is so retarded that there is no surface film, no spreading, and no effective reduction of surface tension.

If the molecule contains two hydrophilic groups attached to opposite ends, the strong water attraction holds the molecule flat on the surface, resulting in a type of film in which the hydrophobic portions of the adjacent molecules are not in sufficiently close proximity to permit the repulsive forces to become important.

It is apparent that, if a substance is to reduce surface tension effectively, it must have a water-soluble, hydrophilic portion (when water is the matrix fluid, otherwise the solubility must be for whatever matrix liquid is used); and it must also have a water-insoluble, hydrophobic por-

tion in its molecule. A proper balance keeps the agent at the surface; yet, there should be enough attraction to the water to cause spreading of the agent and, with it, spreading of the water.

To illustrate what we mean by balance between end-groups, we might think of the surface-active molecules behaving as would nails stuck into corks in such a way that the nails stand up as masts held at the surface of the water by the corks. Hydrophobic portions of the molecules would be the nail heads; hydrophilic portions, the nail in the cork.

The simplest case of wetting is the result of the spreading action we have tried to visualize as caused by the repulsion between molecules of surface-active agents and the subsequent overcoming of the tendency of the liquid itself to present a minimum surface.

The effect of surface-active agents on surface tension is influenced by the presence of water-soluble salts, such as sodium chloride and sodium sulfate. The salts affect the hydrophilic nature of the water-soluble portion making it less water soluble. For surface-active agents having considerable solubility, decreased water solubility may make an agent more effective in reducing surface tension, and vice versa. The properties of a surface-active agent, such as stability and surface tension, depend largely, therefore, on the nature of the end groups of the surface-active agent and the balance achieved between them. The surface-tension value given for a particular liquid by a surface-active agent is a function of the cohesive forces acting between the molecules of the film. Other things being equal, lowered cohesive forces are desired.

Coupled with low surface-tension factors in wetting are such properties as solubility, substantivity, and the condition of the surfaces. Of two liquids, the one with lower surface tension will spread

more rapidly over a clean surface, other conditions, such as viscosity and volatility, being equal. Or, at equilibrium, the liquid with lower surface tension will cover the greatest area, the qualities involved being equal, regardless of viscosity. As we all know, two drops of clean mercury on a clean plate readily join into a single drop; two less pure drops on a dusty plate become a single drop with difficulty.

Many wetting agents, soap being the most familiar example, are rendered insoluble and ineffective in the presence of heavy metal ions, with a change in hydrogen ion concentration, or with a change in salt concentration. Such influences by the varied constituents of a therapeutic preparation must be considered when a special surface-active agent is to be added.

Another factor which must be considered is that the attraction between the surface-active agent and the surface may not be chemical but physical, induced by electrical charges. This property is said to be substantive. These considerations help us visualize, to some extent, how the addition of a surface-active agent may bring about a closer contact of a therapeutic drug with the surface to be covered. Sometimes, this is accomplished by cleaning the absorbing surface; sometimes, by solubility effects; and sometimes, by increased spreading of a film over a surface.

A consideration of the increased penetration of therapeutically active substances through the cornea leads us to a consideration of the rise of a fluid in a capillary tube. Defining surface tension (γ) as the force in dynes required to extend the surface of a liquid along a line one centimeter in length, we have the formula:

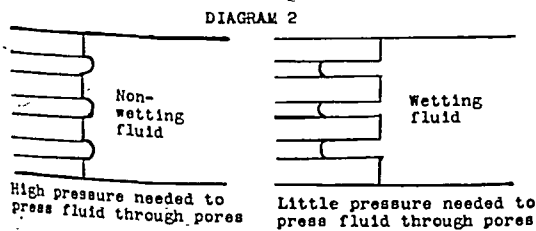
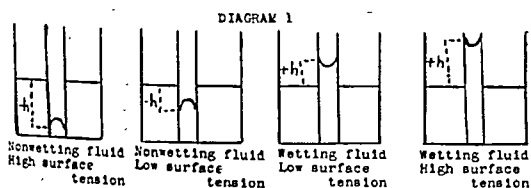
$$\gamma = \frac{h r d g}{2}$$

Where h is the height of rise of liquid in the capillary in cm., r is the radius of the capillary in cm., d is the density of the fluid in g/ml, and g is gravitational acceleration, 980 dynes/cm². We see that, the higher the surface tension, the greater the penetration into capillary pores in the corneal epithelium, unless the value of h is negative. In general, h is positive; that is, when liquid touches the walls of a capillary or pore, the attraction of the molecules of the wall for the molecules of liquid is greater than the attraction of the molecules of liquid for one another. The liquid, therefore, wets the wall of the tube and creeps up the wall to the height calculated as h in the above equation. Obviously, the higher the surface tension, the higher the liquid ascends in the capillary.

If the attraction of the molecules of the wall of a tube for neighboring molecules of liquid is less than the attraction of the liquid molecules for one another (as in the system mercury glass), the liquid will fail to wet the wall and will be depressed rather than elevated, giving a negative value of h . By making a previously non-wetting fluid wet the wall of the capillary, the sign of h may be reversed. For instance, assuming that a membrane has pores of capillary dimensions lined with a fatty material which is not wetted by water, the capillary rise of water in such a pore will be negative. Surface tension, as usually understood in biologic papers, is surface-tension at such an oil-water interface. This surface tension is markedly reduced by such agents as aerosol. If, then, by addition of a wetting agent, as one of the aerosols, sulfosuccinate acid esters, the water can be made to wet the walls of the pore, the rise will become positive. If the height of the pore is less than the height of the capillary rise, the fluid will freely penetrate the membrane.

Assuming that our problem is to stimulate the flow of fluid through a porous membrane, the addition of a wetting agent helps us to accomplish this purpose best if it brings about wetting of the pores with the least amount of coincident lowering of surface tension. A consideration of the paradoxical mechanism of the action of a wetting agent in the penetration of fluid through a capillary pore may help in the choice of a specific wetting agent capable of giving the greatest desired effect.

The following simple diagrams illustrate this idea.



A complete discussion of factors influencing permeability through a semi-permeable membrane would bring into consideration the mechanism of anomalous osmosis, with the complicated concept of a membrane (an aggregate of a number of pores of different sizes), the summation of whose properties is measured by investigation not only of permeability but of diffusion rates, conductivity, dynamic membrane potentials, and so forth. We do not intend to discuss semi-permeable membranes here, only to emphasize the effectivity of wetting as one factor in the theoretical deviation of rate of flow of fluid through a membrane.

When the effectivity of an opthalmic

drug is increased by the addition of a wetting agent, this phenomenon can, theoretically, be attributed to the cleansing action of the wetting agent on the absorbing surface; to the increased solubility of the drug in the epithelium; to the increase of the flow of fluid through capillary pores by bringing about wetting of the pores and, thereby, overcoming the epithelial barrier; or, finally, to the elimination of the epithelial barrier by damage to the corneal epithelium.

Consideration of evidence that the cause of increased corneal permeability in the presence of wetting agents may possibly depend on damage to corneal epithelium is now in order.

Detergents are known to be good protein-denaturing agents. Many are fairly good antiseptics and bacteriostatics. Zephiran has been shown to have a bactericidal effect on *Staphylococcus aureus*.

The addition of minute amounts of a variety of wetting agents and detergents is known to alter certain proteins, poisoning such enzymes as trypsin and lipase, inhibiting the peptic activity of gastric contents, and lowering the biologic activity of lactogenic hormones. These facts make us wonder what harmful results such chemicals may have on the cholinesterase and the lysozym of tears. We ponder the potentialities inherent in inhibiting the activity of these enzymes and others related to the metabolism of the eye. Tears and meibomian secretion, themselves, have constituents which effect the surface tension at the tears-cornea interface, and tears and meibomian secretion, therefore, affect the permeability of the cornea. Tears are a natural wetting agent, and their antiseptic properties, attributable to lysozym, are of considerable importance. We hesitate to neutralize these properties.

Swan (Amer. Jour. Opth., 1944, v. 27, p. 1118) showed that minute con-

centrations of detergents, especially zephiran chloride, as low as 0.025 percent, resulted in a violent reaction in the rabbit eye when injected into the anterior chamber. He reported development of conjunctival edema and desquamation when a single drop of 0.1-percent, zephiran-chloride solution was applied to the human cul-de-sac. Repeated instillations of zephiran chloride in concentrations as low as 0.03 percent produced conjunctival and corneal changes which were reparable when application of the drug was stopped. Leopold (Arch. of Ophth., 1945, v. 34, p. 99) reported conjunctival and corneal damage from repeated applications of detergent solutions, zephiran chloride producing corneal damage in concentrations as low as 0.1 percent. Repeated applications of solutions containing 0.5 percent of each detergent tested definitely retarded regeneration of corneal epithelium, and a 0.1-percent solution slightly retarded regeneration. Alvaro (Arch. of Ophth., 1943, v. 29, p. 615) mentioned increased penetration of sulfonamide compounds into the eye after first using one drop of sodium dioctylsulfosuccinate. This wetting agent is commercially known as decresol OT, and one drop would be very likely to produce corneal damage.

Ginsburg and Robson in the British Journal of Ophthalmology for April, 1945, offer what seem to be the most specious conclusions to date: "The penetration of sodium sulphacetamide into ocular tissues was studied in living rabbits and in isolated ocular tissues. Application of the drug with a wetting agent, Duponal ME dry (derived from Lauryl alcohol), increased penetration of sodium sulphacetamide into and through the cornea. The removal of corneal epithelium caused great increase in penetration of sodium sulphacetamide into and through the cornea; therefore, the epithelium was

acting as a barrier to passage of the drug. The wetting agent did not increase the passage into the denuded cornea (epithelium removed), and so the wetting agent acts by overcoming the epithelial barrier."

They did not say whether the epithelial barrier was overcome by penetration through the barrier because of surface-active effects by the wetting agent, or by damage to the epithelium by the agent. They did suggest that the addition of a wetting agent to sodium sulphacetamide was of value in infections of the cornea and iris. It not only increased the concentration in the anterior ocular tissues but prolonged the period of effective chemotherapeutic concentration.

In conclusion, we might emphasize the advice, given by Swan and by Leopold, that the use of detergents should be considered with a knowledge of their possible toxic properties. In other words, the benefits to be obtained by their use must be weighed against the possibility of damage to ocular tissues in each case for which they are prescribed. Use of detergents in cases where there are abrasions of the corneal surface, might cause regeneration of the corneal epithelium to be unduly retarded. Their use when there are perforations of the eyeball, by injury or operation, might allow sufficient detergent to enter the anterior chamber to produce untoward reaction. These and other possibilities must always be considered.

On the other hand, the seriousness of the condition for which medication is prescribed, particularly the extent of any infectious process, may be so great as to justify any measures that might overcome the infection. The cases in which applications of preparations containing detergents are recommended for use over a prolonged period must be examined at routine intervals to determine whether

any local damage is discernible while it is still superficial.

In brief, we find by theoretical consideration and by actual experimental evidence that certain benefits are attributable to the use of wetting agents and detergents in ophthalmic drugs, but we are left with a realization of the possible toxic effects and a challenge to find better wetting agents with less toxic properties.

S. Rodman Irvine.

OBITUARY

GRADY EDWARD CLAY

1889-1946

Dr. Grady Edward Clay was born November 12, 1889, in the village of Walnut Grove, Walton County, Georgia. He died following a heart attack on July 11, 1946. He was the only child of Augustus C. Clay and Lizzie Chupp Clay. He retired during his last illness to his plantation at Walnut Grove.

Dr. Clay's preparatory education was received in Monroe, Georgia, and Emory College, where he was graduated in 1910. He received his medical degree from the University of Michigan in 1914 and was resident in ophthalmology for the next three years under the able Dr. Walter R. Parker.

He returned to Georgia in 1917 to begin private practice and at that time became an instructor in the eye department of Emory University Medical School. He entered the Army in 1918, serving 18 months overseas with the A.E.F. in France as ophthalmologist in a base hospital. He returned in 1919 and was discharged with the rank of captain. Upon resuming private practice and his association with the department of ophthalmology of Emory University, he rapidly demonstrated his ability and interest in teaching.

Dr. Clay was a member of the Fulton County Medical Society, the Atlanta Eye,

Ear, Nose, and Throat Society, the American Medical Association, Southern Medical Association, Southeastern Surgical Congress, Academy of Ophthalmology and Otolaryngology, and the American



Ophthalmological Society. He served as president and member of the board of trustees of Fulton County Medical Society; chairman of the Ophthalmological Section, Southern Medical Association in 1936; associate editor of the American Journal of Ophthalmology; member of the Council of the American Academy of Ophthalmology; vice-president of the Southeastern Surgical Congress, 1939; and member of the American Board of Ophthalmology. For two terms, from 1936 to 1938, he was president of the Emory University Alumni Association, and served on the university Board of Trustees. He was chairman of the alumni committee that sponsored construction of the present Phi Delta Theta house at Emory University and was elected to Omicron Delta Kappa, national honorary society, for "outstanding service" to the

university. He was a member of the general advisory committee of the National Society for the Prevention of Blindness; and was chairman of the advisory committee on ophthalmology for the Georgia State Department of Public Welfare from 1941 to 1944.

In 1939, he was made chief of the department of ophthalmology and a full professor in 1943. He obtained, through his patients and influential friends, substantial financial aid for the Eye Department and had established a laboratory for ocular pathology and bacteriology.

Grady Clay possessed a forceful personality and was a splendid organizer. In his lectures, he was most instructive to students and staff alike. His great interests were in medical- and neuro-ophthalmology. One of his pet interests was the vascular changes in the retina, and he had striven for years to simplify and gain a more uniform classification of this subject. He spoke repeatedly at the Academy on neuro-ophthalmology in his instructional courses.

In his private practice, he had seen some 70 cases of angoid streaks and was ever searching for the true etiologic factor in these cases. He was an excellent operator, skillful and technically sound. His contributions to ophthalmic literature showed originality, careful preparation, and a thorough knowledge of his subject. An enthusiastic and a forceful speaker, he was a frequent and popular guest at society and post-graduate meetings where his friendliness and cordiality made many friends.

One of Dr. Clay's major interests was the underprivileged in the clinics at Grady Hospital and at his plantation locality, Walnut Grove; here, he gave unstintedly for hospitalization and education at his own expense. He loved outdoor life and sports, was an excellent golfer and a good fisherman. His hobby and avocation

was his pride in the cattle farm where his fine herd of polled-Hereford cattle thrived. At the time of his death, his farm lands were becoming a model for soil conservation and diversification.

In 1915, Dr. Clay married Eleanor Hall Solomon of Macon, Georgia, who predeceased him by several years. He is survived by his two children, Mrs. Lawson Peel Calhoun, of Atlanta, and Grady Clay, Jr., of Louisville, Kentucky, and by three grandchildren. He was a staunch member of the Methodist faith and the patron of his county church at Walnut Grove.

Those of us who worked by his side loved him, knew his worth as a friend, physician, teacher, and humanitarian. His death in the prime of his life is an irreparable loss, leaving a niche that cannot be well filled.

J. Mason Baird.

BOOK REVIEWS

DIE ERKRANKUNGEN DES AUGENHINTERGRUNDES (DISEASES OF THE EYEGROUND). By Prof. Dr. Adalbert Fuchs. Vienna, Austria, Franz Deuticke, 1943. 300 pages, 66 text illustrations, 44 color plates; German language (only a few copies are available at present).

Material for this exquisitely illustrated and concisely written book was collected during the two decades of the author's intensive activities of teaching, research, and consultations at the University of Vienna. He gives a clear description of the essential findings necessary for correct diagnosis of the common, as well as the rare, diseases of the ocular fundus and emphasizes their relation, if such exists, with the other medical specialties.

One of the best points of the book in the reviewer's opinion is the juxta position of clinical and histopathologic find-

ings, without detailed, nonessential histologic descriptions, creating an indelible association in the reader's mind between the clinical phenomena and the underlying pathologic processes. Nineteen of the 44 color plates are histopathologic illustrations, placed in such a way as to make correlation with the clinical condition extremely simple. The material of the entire book is arranged so well that ease of orientation is one of its most pleasant features. A short clinical history contained in the discussion of each colored illustration adds to the liveliness of presentation.

The book was written during the years 1941 and 1942, under great mental, emotional, and physical stress produced by the war, and Professor Fuchs is to be congratulated upon being able to create this masterpiece under such adverse conditions.

The paper of the book and the plates are of excellent, undoubtedly prewar, quality.

Our sincere congratulations go to Professor Fuchs with the best wishes for his future and that of his beautiful book.

Bertha A. Klien.

PHYSIOLOGIE OCULAIRE CLINIQUE. By A. Magitot. Paris, France, Masson & Cie, 1946. Stiff paper covers, 457 pages, 235 illustrations. Price not stated.

Evidently expecting the book to speak for itself, Magitot has dispensed with preliminary preface and introduction. The volume, well printed, well organized, and very readable, is apparently designed for the beginner in ophthalmology. An author

index is lacking, and the bibliography is scanty, inaccurate, and not closely related to the material developed. The seasoned student will miss the assimilation of the latest research, the careful documentation, the encyclopedic detail, and the interpretive insight that so brilliantly characterize Duke-Elder's textbook. Although Magitot, in his earlier chapters, favors unduly many tenuous theories of a previous decade, his treatment of photochemistry is refreshingly different and, surprisingly, includes the latest researches of von Studnitz from Pflüger's Archiv of 1943, in which the iodopsin of Wald is shown actually to consist of three carotenoid complexes homologous to the tripartite system of cone-oil globules found in many birds and reptiles.

In every section, Magitot features an excellent discussion of comparative physiology, and fortunately his stimulating presentation is not relegated to fine print. The author's own numerous researches receive only brief mention but contribute much by giving the volume a personal and authentic flavor.

This book was written under difficult circumstances. The author was in hiding in the south of France, under an assumed name, ignorant of the health and welfare of his family and the state of his property. The liberation of France permitted him to return to Paris where he was united with his family but where, too, he found that the Nazis had ravished his house and library. It is, therefore, all the more remarkable that this excellent work could appear at all.

James E. Lebensohn.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

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| 1. General methods of diagnosis | 10. Retina and vitreous |
| 2. Therapeutics and operations | 11. Optic nerve and toxic amblyopias |
| 3. Physiologic optics, refraction, and color vision | 12. Visual tracts and centers |
| 4. Ocular movements | 13. Eyeball and orbit |
| 5. Conjunctiva | 14. Eyelids and lacrimal apparatus |
| 6. Cornea and sclera | 15. Tumors |
| 7. Uveal tract, sympathetic disease, and aqueous humor | 16. Injuries |
| 8. Glaucoma and ocular tension | 17. Systemic diseases and parasites |
| 9. Crystalline lens | 18. Hygiene, sociology, education, and history |
| | 19. Anatomy, embryology, and comparative ophthalmology |

1

GENERAL METHODS OF DIAGNOSIS

Hughes, W. L. and Cole, J. G. **Technical uses of air in ophthalmology.** Arch. of Ophth., 1946, v. 35, May, pp. 525-540.

This very practical and excellently arranged article should be read in full. The injection of air into Tenon's capsule helps in localizing intraocular foreign bodies inside or outside the eyeball.

In surgical procedures air has been found of value in several ways. In cases of recent laceration of the cornea with incarceration of iris or lens capsule in the wound, mattress corneal sutures are so placed that an air-tight closure of the wound is obtained.

Anterior synechias are apt to recur after the simple incision of the band. Air forms the ideal substance for prevention. A special knife has been constructed, similar to the goniotomy knife, but with a longer blade, with which it is possible to aspirate the aqueous and insert as much air as is

required without removing the knife from the anterior chamber.

Frequently, air can be used after dissection of a secondary membrane or after iridotomy. In two patients, after intracapsular cataract extraction, a mound of vitreous protruded through the pupil. The vitreous was separated from the cornea with a suitable curved iris repositor inserted obliquely at the limbus (vitreodialysis) and air was injected to maintain the separation until the aqueous reformed.

As a final step in cataract extraction, injection of air into the anterior chamber helps to prevent incarceration of tissue in the wound.

In a trephine operation for glaucoma, air injected into the anterior chamber provides a space between the iris-lens diaphragm and the cornea, and some of the air passes out of the trephine opening under the conjunctival flap. Here it provides at least a temporary space by separation of the conjunctival flap from the underlying sclera. In the delayed formation of the anterior chamber after trephination or opera-

tion for cataract, air has been injected into the anterior chamber as an aid in its reformation.

Goniotomy, introduced by Barkan for deep chamber glaucoma, has gained only moderate acceptance because of the difficulty attending the manipulation of the heavy contact glass and the knife at the same time. With the technic that is described it is possible to perform goniotomy in glaucomatous eyes with a shallow anterior chamber, as well as in those with a wide angle.

No contact glass is used. It was demonstrated by animal experimentation that a distinct view of the anterior chamber could be obtained if air was substituted for the aqueous. Work on rabbits and on three human eyes is reported.

Koster, in 1902, used air in the anterior chamber as a therapeutic aid in cases of tuberculous iridocyclitis and keratitis. The authors have had no experience with this use of air.

In the operation for detachment of the retina, many authors have described injection of air into the vitreous with the idea of forcing the retina against the choroid.

The injection of air makes a shallow anterior chamber readily accessible to direct inspection with the slit lamp. Diagnostically the injection of air helps to decide whether a shallow chamber is due to an actual increase of vitreous or lens or to vascular congestion of the choroid. It is interesting to speculate on the diagnostic and therapeutic use of various gases that might be used to deter or combat bacterial growth or otherwise affect abnormal intraocular conditions.

R. W. Danielson.

Lopez-Enriquez. Individual films for the Leica camera. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Feb., pp. 137-138.

A single film carrier for the Leica camera is described. (2 illustrations.)

Ray K. Daily.

Rocha, Hilton. *Cycloplegine*. *Rev. Brasileira de Oft.*, 1946, 4th yr., June, no. 4, pp. 297-301. (See Section 3, Physiologic optics, refraction and color vision.)

2

THERAPEUTICS AND OPERATIONS

Blok, C. J. *Alkaline eyedrops and their stability*. *Ophthalmologica*, 1944, v. 108, Oct.-Nov., pp. 217-223.

Alkaline eyedrops are active in lower concentration because of better penetration. The stability of such solutions was investigated from a chemical and pharmacologic standpoint. Pilocarpine in boric acid solution showed practically unlimited stability, while alkaline pilocarpine solutions should not be kept longer than six weeks. Alkaline solutions of atropine, homatropine, and scopolamine are much less stable and can be used for only three weeks. Boric acid is to be avoided in the latter solutions. The author recommends the addition of 0.03 percent Nipazol or one drop of chloroform per 10 c.c. of solution for better conservation. Three sample prescriptions for pilocarpine, atropine, and scopolamine are given. (Literature.)

Max Hirschfelder.

Cutler, N. L. A basket type implant for use after enucleation. *Arch. of Ophth.*, 1946, v. 35, Feb., pp. 71-83. (See Section 13, Eyeball and orbit.)

Danielson, R. W., and Long, J. C. A method of evisceration of the eyeball. *Amer. Jour. Ophth.*, 1946, v. 29, July, pp. 859-861. (4 figures, references.)

Dubois-Poulsen, A. Penicillin in ophthalmology. *Ann. d'Ocul.*, 1945, v. 178, Dec., pp. 533-555.

The indications and contraindica-

tions of penicillin are now becoming apparent. The tolerance of different tissues varies widely. In the aqueous and cerebrospinal fluid lymphocytosis and fibrogenesis appear as a manifestation of aseptic inflammatory reaction. The therapeutic dose here varies between 200-1,000 units in 0.2 c.c. normal saline solution. The vitreous tolerates approximately 100 units. External applications and instillation of strong solutions have been followed by corneal desquamation. Allergy, though rare, may be local or general, and when it occurs local treatment must be discontinued. Local ocular instillations should be made every two hours during the day and every three hours during the night. The best average strength is 1,000 units per c.c. In severe corneal ulceration penicillin crystals have been applied directly to the wound. The intramuscular or intravenous use is less effective in ocular lesions than the subconjunctival injection of 5,000 units in 1 c.c. of 2-percent procain solution. In iritis, iridocyclitis, and choroiditis, penicillin is of questionable value. This may be owing to the character of the causative organism, the allergic character of the ocular reaction, or to other causes not yet determined. The conjunctival infections with staphylococcus, pneumococcus, the Morax diplobacillus, and the inclusion body infection of the new born, respond to penicillin. Trachoma is apparently not affected by penicillin as much as by sulphonamides. Corneal infections caused by penicillin-sensitive organisms are best treated by subconjunctival injections. In postoperative infection penicillin should be promptly used subconjunctivally or in the anterior chamber, and by local instillation. The eye should be left unbandaged and open as much as possible. The respec-

tive indications of penicillin and the sulphonamides have not yet been established. The report supplements another on this subject published earlier in this Journal (*Ann. d'Ocul.*, 1945, v. 178, March, pp. 81). Numerous illustrative cases are presented.

Chas. A. Bahn.

Effect of antiseptics on regeneration of corneal epithelium. *Bull. U.S. Army Med. Dept.*, 1946, p. 257. (See Section 6, Glaucoma and ocular tension.)

Gibson, A., and Carlisle, J. M. **Industrial first aid in chemical injuries of the eye.** *Sight-Saving Review*, 1945, v. 15, Winter, pp. 220-228.

Immediately after a chemical injury, the patient's eye should be flushed with water at the plant Medical Department. The contents of the conjunctival sac is then tested for its reaction with indicator paper. A local anaesthetic is applied to the eyeball, the lids and conjunctiva are thoroughly cleansed, the cornea is stained with fluorescein, so that these tissues may be examined for abrasions, foreign bodies, lacerations, and chemical burns. Treatment for burns consists of cold compresses, local anesthetics, liberal quantities of penicillin ointment, eye pads, and atropine when needed. For alkali burns, the irrigation should be continued until the secretion remains neutral in reaction. Adhesions should be looked for twice daily.

I. E. Gaynon.

Grosz, Istvan. **Standardization of eye drops.** *Acta Ophth.*, 1944, v. 22, pt. 2, pp. 147-157.

The literature is reviewed and a plea is made for the use of buffered solutions for eye drops. Formulas are given for acid and alkaline buffer solutions, and for the most desirable combinations of

these for the various drugs used in ophthalmology. Ray K. Daily.

Hughes, W. L. and Cole, J. G. Technical uses of air in ophthalmology. *Arch. of Ophth.*, 1946, v. 35, May pp. 525-540. (See Section 1, General methods of diagnosis.)

Jones, C. C. The use of penicillin in diseases of the eye, ear, nose and throat. *J. Iowa M. Soc.*, 1946, v. 36, May, pp. 193-194.

The inhibitory action of penicillin affects the staphylococcus aureus, hemolytic streptococcus, pneumococcus, gonococcus, and meningococcus. Penicillin inhibits the metabolism of the intracellular enzymes of these organisms. Normal saline solution, or certain buffers are the vehicles of choice. An aqueous solution is said to lose 10 percent of its potency every twenty-four hours at five degrees centigrade.

Penicillin is compatible with all drugs that are used in the external diseases of the eye except adrenalin. It has been used to good advantage (1,000 units per c.c.) in dacryocystitis. Penicillin ointment of the same concentration, instilled every four hours, gives better results than the solution in acute catarrhal infectious conjunctivitis. According to O'Brien, penicillin ointment, 1,000 units per gram, is more effective than 5-percent sulfathiazole when combined with meibomian massage and staphylococcus toxoid desensitization in chronic blepharitis and conjunctivitis. Ulcers of the cornea that are resistant to usual therapy have responded to subconjunctival injections of one half c.c. of penicillin, 1,000 units per c.c. twice daily. The procedure is painful and requires local anaesthesia.

In iontophoresis, a solution of 500

units per c.c. is used for three minutes with a current strength of two milliamperes. I. E. Gaynon.

Kohout, J. J. and Callahan, Alston. *Ophthalmopedics*. *Amer. Jour. Ophth.*, 1946, v. 29, Aug., pp. 968-976. (13 figures.)

Law, T. B. Penicillin in preoperative and postoperative ophthalmic surgery. *M. J. Australia*, 1946, v. 1, March 30, p. 442.

A violent reaction resembling early panophthalmitis occurred in a patient after a cataract extraction. Intensive penicillin therapy was instituted immediately. The drug was given intramuscularly (100,000 units in 6 hours), and was also instilled into the conjunctival sac every hour. Within eight hours the eye cleared remarkably and there was uneventful recovery.

The second patient, a man aged 75 years, had a mature cataract, a marked chronic conjunctivitis with muco-purulent discharge, and a history of chronic purulent sinusitis. Repeated conjunctival cultures showed as many as 30 colonies of staphylococcus aureus. Penicillin was instilled in the conjunctival sac every hour for 10 hours, when the sac was found to be sterile. The tear sac was removed despite the fact that it was free from discharge. The cataract was removed after five hourly instillations of penicillin solution and there was uneventful recovery. On departure from the hospital two weeks later 30 colonies of staphylococcus aureus were found in cultures.

F. M. Crage.

Moreu, Angel. The use of pre-anesthetic medication in ophthalmology. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Feb., pp. 134-137.

The author warns against the use of Escofedal and Penumbrol in vagotonic subjects, in whom the administration of these drugs may produce an alarming drop in blood pressure, and bradycardia. A 500c.c. blood transfusion controlled the symptoms in a patient with an alarming drop of blood pressure and a barely perceptible pulse. The author urges thorough general examination of the cardiovascular system, a preliminary administration of a cardiovascular stimulant, and preparedness to meet cardiovascular complications.

Ray K. Daily.

Pinticart de W., Elcira, *Tuberculin therapy in Chile*. *Rev. Brasileira de Oft.*, 1946, 4th yr., June, no. 4, pp. 303-312.

The author uses a series of tuberculin dilutions, the weakest of which are extremely attenuated, and which he numbers according to the number of zeros contained in the strength of the dilution; for example, the description in numerals of number 20 solution being unity followed by twenty zeroes. (References.)

W. H. Crisp.

Schmid, A. E. *The distribution of Irgamid in the tissues and fluids of the eyeball*. *Ophthalmologica*, 1943, v. 106, Nov.-Dec., pp. 289-300.

Irgamid is a sulfanilamide derivative that the author used in experiments on young rabbits.

The Irgamid was used locally in the form of a powder or of a 15-percent ointment, was introduced through a stomach-tube or was injected in a 20-percent aqueous solution into the marginal vein of the ear.

The eyeballs were examined immediately after the death of the animal and the drug content of the individual ocular structures was determined by the

method of Pulver. The concentrations varied considerably with the method and time of administration. The variations from individual to individual were unessential.

Local administration gives a remarkable concentration in the anterior chamber and in the strongly vascularized tissues of the eyeball. This concentration is greater, when the corneal epithelium is damaged, in all tissues except the lens. In the lens the drug concentration, which is usually small, is even smaller in corneal erosions. The concentrations after administration in the powdered form rise rapidly and are rather high. They are lower and of longer duration after using the ointment. Administration four times per day results in the greatest concentration.

In peroral administration the maximum concentration was attained after 10 hours. The conjunctiva, the vitreous, and especially the choroid and retina manifested high concentration and slow elimination.

Intravenous application produced a rapid concentration of the drug in all ocular tissues and fluids, particularly in the vitreous. (9 tables and curves, references.)

Alice R. Deutsch.

Schultz, A. *Ocular dermatitis from local penicillin*. *Arch. of Ophth.*, 1946, v. 35, Feb., pp. 145-149.

Of 52 cases of eye disease treated by the local application of penicillin, two developed symptoms of local tissue hypersensitivity. The eyes were treated with sodium penicillin in salt solution or in ointment in concentrations ranging from 500 to 3,000 units per gm. In the two cases reported ocular dermatitis developed. In the first instance the condition resembled acute dermatitis due to atropine, while in the second

case it simulated contact dermatitis. The allergic reactions gradually subsided with cessation of treatment with the drug.

John C. Long.

Struble, G. C. and Bellows, J. G. Contact eye cup for corneal baths with solutions of penicillin. *Arch. of Ophth.*, 1946, v. 35, Feb., pp. 173-175.

Simple instillation of penicillin eye drops will effect a prompt cure of the acute inflammatory diseases of the conjunctiva caused by penicillin-sensitive organisms. Simple instillation is not adequate in corneal ulcers, particularly if the deep layers of the cornea are involved. A special contact eye cup is described which is made of clear acrylic material. It can be fitted over the eyeball and a small flat handle projects between the lids. The cup has two holes, one for filling it and the other for the escape of air. With the patient in a sitting or reclining position and the eye anesthetized, the cup is inserted and filled with penicillin solution by means of a syringe. The cup is then left in place for one-half to one hour. There is no loss of solution through the lacrimal apparatus nor is there dilution by the tears. The transparent cup permits view of the anterior segment of the globe and the level of the penicillin solution at all times. The contact cup fits both eyes. Illustrated.

John C. Long.

Vejdovský, V. Some experiences with penicillin in eye diseases. *Lékařské Listy*, 1946, v. 1, April 1, pp. 101-104.

This is the first report on penicillin therapy in ophthalmology from central Europe. In two infants with gonorrhoeal ophthalmia of the newborn 30,000 units were used and in three adults with gonorrhoeal eye affections 100,000 units were followed by recovery.

An infected eye with a perforating wound, and an eye with postoperative iridocyclitis recovered after subconjunctival and intramuscular applications of penicillin. Penicillin was also effective in an eye with a serpiginous corneal ulcer.

O. Felsenfeld.

3

PHYSIOLOGIC OPTICS, REFRACTION, AND COLOR VISION

Angius, T. Experimental studies of night blindness. *Rassegna Ital. d'Ottal.*, 1946, v. 15, no. 1 and 2, p. 11.

A group of 51 healthy men between 18 and 21 years of age were studied daily for several weeks to determine the effects of vitamin A upon their light threshold. It was concluded that vitamin A has a specific action, especially to increase the perception of form. The action is either catalytic, favoring the power of fatigued tissue to recuperate, or an augmentation of vitamins to rebuild the visual purple. Vitamin A is therefore indicated in those individuals who need to lower their light threshold and in those who are unduly fatigued or exposed to intense light. (6 figures, 1 table.)

Eugene M. Blake.

Bateman, Eric. The Cantonnet system from the viewpoint of general psychology. *The Optician*, 1946, v. III, Feb. 15, pp. 46-47.

The unilateral repression of an image can be likened to the repression that occurs in the mind when faced with a situation which it finds intolerable. The eye deviates to displace an offending image and the mind at a higher level represses the image, and represses it still more at the macula to keep the eye from turning back. A discussion is given of the ego, the subconscious level, and the conscious level. Apply-

ing the principles of psychology, the treatment consists of a careful refraction, correction of the amblyopia as much as possible, exercises to overcome repression or, as Cantonnet calls it, neutralization, and the development of simultaneous and stereoscopic vision.

I. E. Gaynon.

Clark, Brant, Johnson, M. L., and Dreher, R. E. **The effect of sunlight on dark adaptation.** *Amer. Jour. Ophth.*, 1946, v. 29, July, pp. 828-836. (5 figures, 3 tables, references.)

Crawford, B. H. **Photochemical laws and visual phenomena.** *Proceedings Royal Society Series B*, 1946, v. 133, Jan. 10, pp. 63-75.

Foveal and parafoveal light reactions and recovery of dark adaptation were studied. The explanation of visual phenomena remains undetermined as long as the theory of the kinetics of chemical reactions, upon which they depend, remains unsettled.

F. M. Crage.

Dudragne, R. A. **Physiologic amplitude of accommodation and false accommodation of the aphakic eye.** *Ann. d'Ocul.*, 1945, v. 178, Sept.-Oct., pp. 377-398, 441-452.

The subject is discussed under the following headings: correction of anetropia; corrected accommodation in ametropia; complete correction of the eye; depth of the field of the eye; spheric aberration of the eye; punctum remotum and pupillary opening; physiologic accommodation of the aphakic eye; experimental studies.

The mathematical analysis of each topic is presented in detail. Increased size of the pupil in twilight may increase the focal power of the eye as much as two diopters. Some of the fac-

tors involved in accommodation are best studied in the aphakic eye in which a false accommodation may be as great as five diopters. Among the factors that bring it about are: the distance of correcting lenses from the cornea; astigmatism that is caused by angulation of correcting lenses; unequal focal power of different sectors of the cornea; occupational familiarity with the interpretation of images; pressure on the eye by the lids; depth of the visual field; and spheric aberration of the eye.

Chas. A. Bahn.

Gonzales, J. B. **Dark adaptation in pregnancy.** *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Feb., pp. 120-128.

Forty women in the second half of pregnancy were examined with the Birch-Hirschfeld adaptometer. Their adaptation curves, while within physiologic limits, are somewhat inferior to the normal controls. Eight percent of the patients had definitely subnormal adaptation curves, but none of them had subjective hemeralopia. The adaptation of women on diets adequate in vitamin A were no different from those on inadequate diets. The adaptation curves show no variation during the months of the second half of pregnancy. (Adaptation curves.)

Ray K. Daily.

Göthlin, G. F. **Inhibitory processes in the normal mechanism of the color sense.** *Ophthalmologica*, 1944, v. 107, March-Apr., pp. 158-177.

From his experiments the author concludes that the fundamental color sensations of man are red, green, and blue, not violet. From observations when mixing complementary colors in different proportions, and from the existence of negative ordinates in Maxwell's and Wright's graphically ex-

pressed measurements of three-color synthesis of spectral monochromatic colors, the author infers that each excitatory impulse that proceeds from the color receptors is accompanied by an inhibitory nerve impulse to the substratum of its complementary color. It is assumed that the sensation of yellow results from a central coordination of impulses which come from the red and green receptors. This synthetic yellow plus fundamental blue, if the impulses are equally strong, give the sensation of white. The author expresses the opinion that the negative afterimage has its origin in elements that were inhibited during the presentation of the positive color and spontaneously come into a state of excitation after the positive color disappears. The differences between the author's hypothesis and the theories of Young-Helmholtz and of Hering are discussed. (Bibliography.) Max Hirschfelder.

Göthlin, G. F. An analysis of the perception defect in published and spectroscopically investigated cases of congenital tritanopia. *Acta Ophth.*, 1943, v. 21, pt. 1-2, pp. 88-96.

An analysis of the published cases of congenital yellow-blue blindness shows that they form two different categories. One group of blue-blind subjects have color sensations from the violet part of the spectrum. The second group is both violet and blue blind, and also has a simultaneous weakening of perception of long-wave red. This later group therefore comprises the pure cases of tritanopia. One of the two typical tritanopic subjects examined saw spectral violet as pale red, and the other as red dotted with small black spots. These data indicate that violet is a product of simultaneous stimulation of blue and red. The fact that in the ab-

sence of blue perception violet takes on the character of red gives further support to the author's contention that violet is a product of simultaneous fundamental sensations of blue and red.

Ray K. Daily.

Göthlin, G. F. Participation of central inhibitory processes in the synthesis of color sensations. A working hypothesis. *Acta Ophth.*, 1943, v. 21, pts. 1-2, pp. 75-87.

With the help of a double-balance model, Göthlin outlines his theory of color perception, which assumes that every impulse from retinal receptors for a color sensation is always combined with a certain degree of central inhibition of the complementary color in the same area. According to his theory the sensation of white is developed in two stages; in the first a balance between impulses for red and green produces yellow; in the second yellow and blue produce white. This theory, contrary to the Young-Helmholtz theory considers blue as a fundamental color, and differs from Hering's theory in assuming that yellow is the result of central synthesis of green and red, and denying that red and green are complementary colors. For experimental evidence supporting his theory reference is made to the *Journ. of Phys.* v. 57, and to the *Handlingar of the Swedish Academy of Science*, Ser. 14, v. 20: 7.

Ray K. Daily.

Hardy, L. H., Rand, G. and Rittler, M. C. Tests for detection and analysis of color blindness. *Arch. of Ophth.*, 1946, v. 35, Feb., pp. 109-119.

This is a report of data collected in the study of 106 persons with defective color vision of varying types and amounts by means of various editions of the Ishihara test for color blindness.

A comparison of the average scores and the range of scores for the different types of deficiency in color vision does not show notable differences in the fifth, seventh and ninth (British reprint) editions of the Ishihara test. Properly administered, the three editions of the test afford a good rough device for screening persons with defective from persons with normal color vision if a performance score of 60 is taken as the critical score. A critical score cannot be established for the 10 Ishihara plates reproduced in the American Optical Company's test. Tested with this group of plates, some subjects with defective color vision passed all the plates and some with low normal color vision passed only six of the plates.

John C. Long.

Hartridge, H. Recent advances in the physiology of vision. *Brit. M. J.*, 1946, April 27th, pp. 637-638.

Goldman and Hagan measured the length of the eyeball by passing a beam of X rays through a slit in a stout metal plate. A narrow ray is produced that falls on the observer's dark adapted eye at right angles to its optic axis. A beam of light is seen concentric with the fovea. As the beam moves backward in the eye, it becomes narrowed to a point and coincides with the most posterior part of the retina. The beam is then moved forward until it coincides with the anterior part of the cornea. The movement is carefully measured. Total refraction of the eye is measured by the following procedure. Two narrow beams, five millimeters apart, are projected in at the front of the eye just below the line of sight. Two narrow beams are projected by an optical lantern on a screen and are adjusted until they coincide with the X-ray images. The distances are care-

fully measured. Total refraction in diopters equals 1000 times distance between lantern beams divided by screen distance times the distance between X rays. Their mean values are as follows: length of eyeball equals 24.05 millimeters; total refraction equals 58.75 diopters; nodal distance equals 17.02 millimeters; posterior focal distance equals 22.73 millimeters.

Granit's work on the micro-electrode experiments depends upon the principle that when a sensory nerve is stimulated, it undergoes a change of electrical potential. The retina of an animal is exposed and a single optic nerve fiber is stimulated and the change in potential measured. He found eight types of receptors. Type 1 is the dominator; the remaining seven are called modulators. There is one modulator for orange, one for yellow, three types for different shades of green, and two for blue.

Using the Landolt ring test, Schlaer found little difference in the visual acuity when lights of different colors were compared to white. An experiment is also described wherein the spurious colors of chromatic aberration are eliminated by a nervous process called the antichromatic response.

I. E. Gaynon.

Hylkema, B. S. Examination of the visual field by determining the fusion frequency. *Acta Ophth.*, 1942, v. 20, pt. 2, pp. 181-193.

This investigation was made by arranging the test-field in the form of a campimeter, and taking the fusion frequency at various areas in the field. The graphically recorded data show that there is a region of low fusion frequency in the vicinity of the blind spot. The fusion frequency is lower in the upper than in the lower part of the field. The highest figure is found nasal-

ly and the lowest temporally. In normal binocular vision the temporal downward area in the visual field of one eye corresponds to the nasal downward area of the contralateral eye. Therefore, when an object is less than 30 degrees from the fixation point, the function of the eye, which fixates the object nasally, must predominate. If the object lies to the right, the left eye predominates. When the object is farther in the periphery, the eye on the same side takes over the task. The fusion frequency test demonstrates more effectively than any other test the predominance of one half of the visual field over the other. Ray K. Daily.

Hylkema, B. S. **Fusion frequency with intermittent light under various circumstances.** *Acta Ophth.*, 1942, v. 20, pt. 2, pp. 159-180.

This investigation on the fusion frequency discusses the frequency at high light intensities, and with interaction. It was found that the fusion frequency peak is formed under an illumination of 200 to 800 candle power per square meter. The author suggests that this light intensity might represent the optimum illumination for visual functioning, and serve in the evaluation of lighting conditions. After reaching this peak, further increase in light intensity results in a drop in the fusion frequency; at the state of adaptation at which the fusion frequency curve drops signs of dazzling appear. The diminished color sensitivity associated with dazzling and the lowered fusion frequency point to a temporarily impaired visual function.

Interaction was investigated with the use of two or four intermittently illuminated test fields, synchronously or in opposing phases. The charted results show that interaction is stronger

in the periphery than in the center; it is effective across a longer distance in the periphery, up to five degrees, which corresponds to 0.5 millimeters on the retina. The experiments show that in addition to the light intensity, the size of the illuminated area is also a factor in the fusion frequency. An attempt was made to ascertain the degree of cerebral influence on the fusion frequency by making observations monocularly and binocularly. The figures obtained with one or both eyes differ but little from each other. This is interpreted to indicate that by far the larger share in this process is taken by the retina, and that the cortical influence is slight. Light intensity produces its effect largely in the retina. Area effect and interaction is ascribed to the associative nervous system of the retina. The state of adaptation is determined by the outer layer of the retina, and perhaps also by the central nervous system. Local adaptation that occurs with a long exposure is largely a cerebral process. Ray K. Daily.

Khan, N. E. **Vitamin A and night vision.** *Indian Med. Gazette*, 1945, v. 80, Dec., p. 608.

Dark adaptation studies were made in 190 British Military Personnel and 1,090 Indian soldiers. Sankaran's photometer showed defective dark adaptation in 14 percent of the British and 29.2 percent of the Indian soldiers. Thirty-eight (3.5 percent) of the latter complained of night blindness although there were only two who could not see in the dark. This condition therefore is not as common as is supposed. All but one of the 26 Indians treated with vitamized oil developed normal dark adaptation within two weeks.

Recent data on Vitamin A are discussed. Greater use of carrots and

greens of the spinach type, such as saks, is suggested to improve Indian nutrition.

F. M. Crage.

Mann, Ida, and Sharpley, F. W. The normal visual (rod) field of the dark adapted eye. *Jour. Physiol.*, 1946, v. 104, April 15, pp. 384-391.

The authors tested one eye of each of 47 subjects after dark adaptation. They used a perimeter of 33-cm. radius, a radium target below the cone threshold as stimulus, and a red light for fixation point. The angular radius, that is the angular distance from the center of the plotted field, was calculated as an average of the plotted values of the 24 meridians at 15-degree intervals. The size of field seemed to decrease with increase in age of subject. The fields differed considerably in shape, but the area as expressed in terms of its mean angular radius was fairly constant. Low errors of refraction apparently were negligible. (2 tables, 2 figures, references.)

Bennett W. Muir.

Martin, D. H. H. Some refinements in cross cylinder technique. *The Optician*, v. 111, May 24, 1946, p. 330.

The writer uses the cross cylinder because it puts less demand on the intelligence of the patient, is more rapid, and blends well with the objective examination.

Certain test letters are recommended for the testing of the axis. For estimating axis direction at approximately 90 or 180 degrees, he recommends the letters E, F, H, L, and T; to estimate axis direction at 45 or 135 degrees the letters V, W, X, and Y, and to test cylinder power in the same positions the letters E, F, H, L, and T.

I. E. Gaynon.

Matteucci, P. Quantitative and qualitative perimetric studies with monochromatic and white targets. *Rassegna Ital., d'Ottal.*, 1946, v. 15, no. 1 and 2, p. 26.

Using monochromatic and white targets of equal subjective brilliance revealed findings quite diverse from those of previous investigators. The threshold of light was determined in each subject by photometric measurements. With equality of size, saturation, and brilliance of the target used, and with minimal variations of illumination and of adaptation, important modifications of the peripheral limits for colors were found.

Varying degrees of sensibility of the retina for a single color and other factors not easily controllable make it difficult to define exactly the peripheral limits for colors. The author expresses doubt as to the utility of clinical perimetry with colors. (1 figure.)

Eugene M. Blade.

Parker, F. W. Studies on dark adaptation in military personnel complaining of "night blindness." *Arch. of Ophth.*, 1946, v. 35, May, pp. 555-571.

A fairly common complaint of patients seen by the ophthalmologic service at the front is poor night vision.

Sixty-six patients were examined with a Nagel adaptometer for determination of dark adaptation. Careful ophthalmologic examinations were made, and neuropsychiatric consultation was secured when indicated. Thirty-nine patients of the group complained of moderate to extreme night blindness. Fourteen had no ocular complaints, and 13 were patients with hepatitis. Of the 14 patients with no ocular complaints, all showed normal adaptation curves. Of the 39 patients

who complained of night blindness, 5 with moderate complaints showed normal dark adaptation, and three of these had more than 1.50 D. of astigmatism. For six others with normal readings but severe complaints detailed histories revealed some incident that had caused the patient to believe that his night vision was inadequate. The remaining 28 of the 39 patients had initial low readings for dark adaptation. No cause for this could be found in 5 patients, and these men were considered to have true simple hemeralopia; 4 had a pathologic condition of the fundus; 5 patients proved to be malingering, and 14 were psychoneurotic. Of the 19 patients who were malingerers or psychoneurotic, 11 had corrected vision of 20/40 or less, and 12 had refractive errors of above 1.50 D.

A test for malingering is described which utilizes optokinetic nystagmus.

Six patients with chronic disease of the liver showed subnormal dark adaptation. Three of these persons were given oral vitamin A therapy, with pronounced improvement. Six patients with infectious hepatitis, whose disease did not become chronic and whose hospitalization did not exceed 15 weeks, showed normal dark adaptation curves.

R. W. Danielson.

Pescatore, C. **The operation of Fukala in high myopia.** *Rassegna Ital. d'Ottal.*, 1946, v. 15, no. 1 and 2, p. 48.

The author reports six cases of high myopia in which clear lenses were removed by aspiration. He concludes that the operation is not free from severe postoperative complications, but that the improvement in vision warrants the risks. The best time for operation is between 8 and 20 years of age, and the operation is most successful in eyes

with about 20 diopters of myopia. Fundus changes are not a contraindication to the operation and discission of the capsule is usually required.

Eugene M. Blake.

Pincus, M. H. **Unaided visual acuities correlated with refractive errors.** *Amer. Jour. Ophth.*, 1946, v. 29, July, pp. 853-858. (2 tables, reference.)

Rand, G. **Relation between illumination and visual efficiency.** *Arch. of Ophth.*, 1946, v. 35, May, pp. 509-513.

Rand quotes Weston's investigation which was undertaken to test the value of a method suggested by Beutell for determining the level of illumination required for the efficient performance of work that involves visual discrimination. The method is based on the proposition that the illumination required for any visual task, as compared with the simplest possible task, depends on certain conditions adversely affecting its performance, that these conditions can be defined, and that if the relationship can be ascertained between each of the conditions and the illumination required to compensate for it, then the illumination suitable for the performance of the task ought to be capable of actual computation.

A discussion of the various factors involved in illumination and visual efficiency is given.

From a practical point of view, Weston's studies and those of Ferree and Rand show that level of illumination cannot compensate entirely for the adverse conditions of small size of detail and poor contrast in the work. When the task is such that these factors cannot be improved the level of illumination should be made as high as is compatible with other factors of good

lighting, such as freedom from high brightness and high brightness ratios in the field of view. In most cases of this type it is likely that the most favorable illumination will be furnished by a good general level of background illumination, free from glare and high brightness ratios, supplemented by local lighting of the immediate task, the source of which must be well shielded from the eyes of the worker.

R. W. Danielson.

Redlich, F. C., Callahan, A. and Mendelson, R. H. **Electroencephalographic change after eye opening and visual stimulation.** *Yale J. Biol. and Med.*, 1946, v. 18, May, pp. 367-376.

In a study of 100 subjects, the electroencephalographic changes upon eye opening, which were not uniform, were characterized mainly by a decrease of amplitude and less by increase in frequency of the occipital rhythm. These changes were usually reversed by closing the eye. Three patients with bilateral blindness showed no changes. The effect on the electroencephalogram caused by the opening and closing of the eye does not permit a consistently valid differentiation between true and hysterical, and malingered blindness. (1 table, 4 figures, references.)

Bennett W. Muir.

Rocha, Hilton. **Cycloplegine (Benzoil-diethyl-aminol-ethanol).** *Rev. Brasileira de Oft.*, 1946, 4th yr., June, no. 4, pp. 297-301.

This substance is one of those recently proposed as substitutes for homatropine, to which they are considered superior in regard to brevity of action and of speedy return to normal. Parenthetically, credit is given to Swan and White for their studies of di-n-butylcarbaminolcholine. The author

concludes that cycloplegine is "on the right track," and that in certain special aspects it is very superior to homatropine and atropine, although he admits that it shows a striking tendency to cause lacrimation, which may interfere with the usefulness of the drug.

W. H. Crisp.

Sorensen, S. K. **Lenticular astigmatism, designated as the difference between total and corneal astigmatism, illustrated by an examination of its variations with age.** *Acta Ophth.*, 1944, v. 22, pt. 4, pp. 341-385.

In this laboratory investigation the corneal astigmatism was measured with the ophthalmometer and total astigmatism with the refractometer. The graphically presented data and the calculations based on them lead to the following conclusions. Corneal astigmatism is the most important factor in total astigmatism. In corneal astigmatism against the rule the total astigmatism is against the rule and greater than the corneal astigmatism. In the absence of corneal astigmatism a small degree of total astigmatism against the rule is generally present. With weak corneal astigmatism with the rule one usually finds a total weak astigmatism against the rule or no astigmatism at all. In moderately high corneal astigmatism with the rule, the total astigmatism is also with the rule but lower than the corneal. In very high corneal astigmatism with the rule one often finds a high total astigmatism. The total astigmatism shifts with age so as to bring an increased astigmatism against the rule. The corneal astigmatism varies within wide limits. In children and young people 0.75 D. of astigmatism with the rule may be considered physiologic and 0.50-0.75 D. is physiologic in older persons. At 50 to

60 years of age no astigmatism or very weak corneal astigmatism with or against the rule is physiologic. In the aged weak astigmatism against the rule is most frequent. Thus it is seen that the senile corneal changes direct the corneal astigmatism against the rule. Lenticular astigmatism is very frequent; usually it is very weak, but it may reach considerable proportions. The strongest lenticular astigmatism found was 2.00 D. Lenticular astigmatism is usually against the rule. In children and young people 0.75 D. of lenticular astigmatism against the rule is physiologic. In older people 0.50 D. lenticular astigmatism against the rule is common. In the aged lenticular astigmatism usually does not exceed 0.25-0.50 D. against the rule. Weak degrees of corneal astigmatism with the rule are usually compensated by lenticular astigmatism against the rule. Moderately high corneal astigmatism with the rule is partially neutralized by lenticular astigmatism against the rule. In high corneal astigmatism the lenticular astigmatism is usually of the same type. Corneal astigmatism against the rule is usually associated with lenticular astigmatism against the rule. With age the lenticular changes modify the refraction of the lens in the direction of astigmatism with the rule. Lenticular astigmatism is very variable and in determining refraction the total astigmatism should be considered. (13 graphs.)

Ray K. Daily.

Stenstrom, Solve. **A new method for exposing unilateral simulated reduction in visual acuity.** *Acta Ophth.*, 1943, v. 21, pt. 3, pp. 237-244.

The method utilizes crossed polarization spectacles and a polarized filter in front of an illuminated transparent chart. The manipulation of the filter

from behind the housing which contains the chart, lamp, and filter enables the examiner to transfer the visibility of the chart from one eye to the other without the patient's knowledge.

Ray K. Daily.

Still, D. C. **The calculation of lens effectivity and astigmatic difference at near.** *The Optician*, 1946, v. 111, Feb. 15, pp. 43-45.

This article does not lend itself to abstracting. The mathematics of lens effectivity for far and near is carried out for plus and minus spheres and cylinders to explain the difference in power of astigmatic corrections for distance and for near work.

I. E. Gaynon.

Swaine, W. **The arithmetic of thin lenses. Conjugate foci.** *The Optician*, 1946, v. 111, May 24, pp. 327-329.

The excess of vergency of the refracted rays above the incident rays is constant and equal to the power of the lens. Using the formula $L + F$ equals L ; where L equals image-distance, F equals the focal length of the lens and L equals the object distance, the author demonstrates how the formula may be easily remembered as the path of rays passes from the object through the lens to the image.

I. E. Gaynon.

Ten Doesschate, J. **The relation between visual acuity and the differential threshold of brightness sensation.** *Ophthalmologica*, 1944, v. 108, Oct.-Nov., pp. 187-209.

The differential threshold in comparing two brightnesses B and B' is determined under such conditions that the brightness B fills the whole visual field (inside wall of a globe) while B' is being observed in the shape of a circular testfield (visual-angle g) with foveal fixation. B' is projected through an

opening in the globe on B. It is found that the differential sensitivity increases with an increase in B and with an increase of the visual angle. The stage of adaptation influences the differential sensitivity, as the differential sensitivity is diminished in an eye which is not adapted to a lesser general brightness B. It is shown that visual acuity and differential sensitivity depend in an identical way on the brightness B. The results of the experiments are in accordance with recent calculations of de Vries, which take into account the statistical fluctuations in the number of light quanta, which are projected on the different retinal regions. (Bibliography.)

Max Hirschfelder.

Wartenberg, R. **Associated movements in the oculomotor and facial muscles.** Arch. Neurol. and Psychiat., 1946, v. 55, May, pp. 439-488.

Based upon the study of four patients, a critical analysis is presented of the commonly accepted hypothesis that associated movements in the territory of the third nerve are due to a misdirection of regenerating fibers. It is suggested that the release phenomenon of Hughlings Jackson more accurately explains these phenomena. After incomplete recovery from third nerve paralysis abnormal phenomena occur, such as the retraction of the upper lid with downward rotation of the globe (pseudo-Graefe phenomenon), and pathologic vasomotor and secretory phenomena. The author gives many reasons why the misdirection theory is untenable. The phenomenon occurs when there has been no trauma to the nerve, or before regeneration could have occurred, or as a congenital anomaly. Once established it is present for life. Associated movements are compared with the symptoms of py-

ramidal tract lesions, and are found to be similar. The author says "The hypothesis of released phenomenon propounded here, though it may appear somewhat hazardous, seems to be a workable, expandable one, capable of providing further supporting argumentation." (Photographs, references.)

Bennett W. Muir.

4

OCULAR MOVEMENTS

Bender, M. B. and Teuber, H. L. **Nystagmoid movements and visual perception, their interrelation in monocular diplopia.** Arch. Neuro. and Psychiat., 1946, v. 55, May, pp. 511-529.

Two cases of transient monocular diplopia were studied. It is concluded that the nystagmoid ocular movements which are associated with fixation are necessary but are not sufficient for the development of monocular diplopia. (3 figures, references.)

Bennett W. Muir.

Bertotto, E. V. **Congenital paralysis of the lateral rectus and melanosis bulbi.** Anales Argentinos de Oft., 1945, v. 6, Apr.-May-June, pp. 60-62.

The left eye of an 18-year-old youth had a visual acuity of 6/6, the skin of the lids and the sclera were discolored a slaty gray, the iris was heterochromic, and the lateral rectus was paralyzed, though no diplopia was present. The fundus was normal. The author offers no treatment, and gives a good prognosis. Edward Saskin.

Broendstrup, Poul. **The squinting position of weak-sighted eyes.** Acta Ophth., 1944, v. 22, pt. 4, pp. 386-393.

The material of this investigation comprises 162 patients with impairment of vision in one eye, and normal

visual acuity in the other. The cause of the impaired vision was spontaneous or traumatic unilateral cataract. Most eyes had been operated upon and were aphakic. The material was divided into 3 groups: congenital cataracts, cataracts acquired before the tenth year of life, and those acquired after the age of 11 years. The data of group one indicate that convergence is the position of rest in early childhood, and divergence dominates the picture later. The data of the second group indicate that the older the individual is at the onset of the cataract, and the longer the amblyopic period, the more will divergence dominate as a position of rest. In patients affected under five years of age divergence and convergence will be equally frequent during the first 12 years. If defective vision sets in after the age of five years divergence will be the dominant position of rest. In group three divergence is the dominant position. The data show that when binocular vision is abolished because of unilateral visual impairment the axes of the eyes rarely remain parallel, and that the deviation continues to change for many years. (3 graphs.)

Ray K. Daily.

Foster, J., and Pemberton, E. C. **Effect of operative alterations in the height of the external rectus insertion.** *Brit. Jour. Ophth.*, 1946, v. 30, Feb., pp. 88-92.

In 26 patients who were to have surgery for strabismus, careful measurement revealed vertical phorias of varying amounts. At operation the external rectus, in addition to being advanced or recessed, was raised or lowered on the sclera. Elevation of the muscle raised the eye and lowering it depressed the eye. The results apparently justify the procedure. The measurements of the

muscle functions in each patient are presented in tabular form.

Morris Kaplan.

Gallo, L. A., and Novick, R. **Paralysis of the external rectus. Its treatment with transplants from the superior and inferior recti.** *Anales Argentinos de Oft.*, 1945, v. 6, July-Aug.-Sept., pp. 101-103.

Paralysis of the right lateral rectus muscle appeared in a girl, 19 years of age, after typhoid fever. To overcome it a 6-mm. recession of the internus was done, a temporal slip from the inferior rectus muscle and the superior rectus was attached to the insertion of the lateral rectus, and the latter muscle was advanced. Sixty degrees of abduction was achieved. (1 illustration.)

Edward Saskin.

Gibson, H. W. **The spheres of orthoptics and surgery in the treatment of strabismus.** *The Optician*, 1946, v. 111, June 21, pp. 413-415.

The primary aim of all treatment of strabismus should be the restoration of normal binocular stereoscopic vision. Orthoptic treatment alone is indicated when the ocular muscles are not affected by malformation, paralysis, or paresis. Surgery alone seldom restores binocular stereoscopic vision. It is cosmetic in effect and is used alone when conditions are unfavorable for the attainment of stereopsis. In preoperative orthoptic treatment one strives to eliminate suppression and to teach the patient to learn to use both eyes simultaneously. Post-operative orthoptic treatment ensures accurate alignment of the visual axis with the establishment of stereopsis. I. E. Gaynon.

Nordlow, V. W. **The pathogenesis and early operation of constant con-**

vergent strabismus. *Acta Ophth.*, 1945, v. 23, pt. 2, pp. 97-125.

Nordlow favors early operation, and this study contains the tabulated observations on 23 children who were operated upon early. They were in their second year or older when the strabismus was noticed. At operation the youngest patient was not quite two years old, and the oldest just over eight. The operation consisted of a bilateral partial tenotomy of the internal rectus muscles and resection of the external rectus. The author concludes that early operation cures the strabismus and leads to binocular vision in 91 percent of patients. The strabismus is believed to be a hereditary defect. (7 illustrations.)

Ray K. Daily.

Nordlow, Waldemar. The pathogenesis of convergent strabismus. *Acta Ophth.*, 1942, supplement 20, pp. 134.

The objective of this monograph is to assess the role of refraction, fusion, and mechanical factors in the pathogenesis of internal strabismus. The data obtained by an examination of 105 normal children, seven to nine years of age, 100 normal adults between 23 and 40, and 334 patients with strabismus under 40 years of age are analyzed. The examinations determined the angle of squint, the position of the visual lines, the range of motility, refraction, retinal correspondence, and range of accommodation. The history furnished data on the age at the onset of squint, the course of the strabismus, and the concurrent occurrence of disease. The findings show that normally there is no significant difference in the range of horizontal motility in children and adults. In squinters the primary angle of strabismus at 5 meters was most constant and chosen for comparative study. After the elimination of doubtful

cases, paresis appeared to be a factor in 17.5 percent. In 59.4 percent the angle of strabismus was dependent on the accommodation.

In 177 older patients with strabismus the range of ocular motility was normal in extent in both eyes, but shifted inwards. In 66 percent of these the shift corresponded with the primary angle of strabismus. In as much as the shift can be accounted for only by a mechanical abnormality, it is probable that the mechanical abnormality is also the cause of the strabismus. In 30.5 percent the shift of ocular motility was less in extent than the angle of strabismus and in 3.4 percent it was greater. In 138 patients with permanent strabismus over eight years of age 15.9 percent had normal retinal correspondence. The age at the onset of strabismus differed from that found by Smith and Worth. The frequency in this material was highest in the first year, and gradually diminished to the eighth year. In strabismus noted at birth the factors accounting for it must have been present at birth or earlier. Of 253 patients under seven years of age, 97.8 percent were hyperopic, 1.4 percent emmetropic, and 0.8 percent myopic. In 42 patients seen in their first year of life atropinization and the wearing of the refractive correction had no effect on the angle of strabismus, which indicates the action of a mechanical factor in the genesis of the squint. In 58 percent of the patients the ability to fuse appears to have existed at the onset of squint. All patients with periodic squint had a fusion faculty. Illness preceded the onset of squint in 11.8 percent of the patients; in these there is the possibility of a disturbance of fusion due to meningitis or encephalitis. The author concludes that a mechanical factor which can produce a

deviation of the visual axis even in the presence of the fusion faculty is present at the onset of permanent strabismus. In half of the cases a disturbance of fusion did not appear to be a factor. Periodic strabismus can be differentiated into two types. In one type the deviation can be attributed solely to a mechanical factor and in the other type a refractive error also plays a part. (31 tables.) Ray K. Daily.

Nordlow, W. A. **An instrument for measuring the muscle resection in strabismus operations.** *Acta Ophth.*, 1944, v. 22, pt. 1, pp. 49-51.

The instrument consists of a strabismus hook calibrated in millimeters and a muscle clamp, the length of which is equal to the distance from the 0 point on the hook to its curved end. (5 illustrations.) Ray K. Daily.

Ochoa, R. G. **Anomalous congenital strabismus.** *Anales Argentinos de Oft.*, 1945, v. 6, July-Aug.-Sept., pp. 89-97.

A boy, 10 years of age is described, in whom there were bilateral exophthalmos, esotropia with deviation of the left eye, narrowing of the palpebral fissure of the left eye on adduction, and a weakness of the left lateral rectus. The author reviews several similar cases reported in the literature, and divides them into two groups: those with retraction of the globe on adduction, and those without retraction. When there is retraction there must be a pathologic derangement at the origin of the lateral rectus muscles. When there is no retraction the lesion is probably nuclear. If surgery is contemplated, it should be directed toward attaching a slip of muscle from the superior and inferior rectus muscle to the lateral rectus. (Bibliography.)

Edward Saskin.

Pascal, J. I. **Charting diplopia and muscle action.** *Amer. Jour. Ophth.*, 1946, v. 29, August, pp. 1001-1006. (5 figures.)

Scaglione, C. **Miner's nystagmus in the mines of Sardinia.** *Rassegna Ital. d'Ottal.*, 1946, v. 15, no. 1 and 2, p. 20.

In an examination of 30,000 miners in Sardinia the author could not find a single case of miner's nystagmus. He attributes this fact to the conditions under which the laborers work, that is in the erect position, in excellent illumination and good ventilation, and without explosives. All of these factors lessen the psychopathic tendencies which tend to produce miner's nystagmus.

Eugene M. Blake.

5

CONJUNCTIVA

Apin, K. **Trachoma control in Latvia.** *Klin. M. f. Augenh.*, 1943, v. 109, May-June, p. 322.

Apin reviews a campaign for the control of trachoma which he carried out in Latvia during the years 1926 to 1940. During that period of 15 years 1029 trachoma patients, or 3 percent of the total number of eye patients were included in this state-wide program. It was found that most patients did not receive effective treatment early enough. The incidence of trachoma was definitely higher in women than in men, possibly because women who take care of trachoma-infected children are more exposed to the infection. Only 36.8 percent of patients were free from complications when treatment was begun. Normal vision in both eyes was found only in 26.6 percent of the patients, and chiefly in the young. Screening of the whole population is difficult or impossible because communities are widely

scattered and the majority of the few available ophthalmologists are in Riga. It is important to discover the disease as early in life as possible. School physicians must examine all pupils for trachoma at least twice a year and industrial employees must be examined at regular intervals. The practicing physicians must check for trachoma all patients who consult them for other ailments. Persons who are exposed to trachoma are watched especially carefully. The names of patients who have trachoma must be reported.

F. Nelson.

Bhat, P. K. **Diphtheritic conjunctivitis complicating septicemia.** *The Antiseptic*, 1946, v. 42, May, pp. 317-319.

The author describes a boy, eight years of age, who had all the signs of septicemia as well as a bilateral severe conjunctivitis. A thick gray membrane covered the conjunctiva and cornea. No cultures or smears were taken, but there was an almost immediate response to diphtheria antitoxin. Twenty thousand units were injected on three consecutive days.

I. E. Gaynon.

Byrn, Willy. **Three cases of hemangioma of the subconjunctiva.** *Acta Ophth.*, 1944, v. 22, pt. 2, pp. 166-175.

Histologically one hemangioma was of the cavernous type, one simple, and the third was untreated and unavailable for microscopic examination. The literature is reviewed and the 67 reported cases analyzed as to the age of observation, localization, and microscopic structure. The data indicate that the neoplasm is mostly congenital; in rare cases trauma is a factor. The place of predilection is the inner canthus and the adjacent bulbar conjunctiva. The conjunctival angiomas have a tendency to grow into the eye muscles and into

the orbit and should therefore be removed early. (2 illustrations.)

Ray K. Daily.

Ficandt, Olaf. **A papilloma of the conjunctiva originating in the plica semilunaris.** *Acta Ophth.*, 1944, v. 22, pt. 1, pp. 44-48.

This presumably benign neoplasm, excised from a man 64 years of age, is described clinically and histologically. The variations in the structure of the neoplasm, the difference in the size of the nuclei, and the numerous mitotic figures suggested malignancy. The case illustrates the importance of histologic examination. (3 illustrations.)

Ray K. Daily.

Gartner, S. **Method for biomicroscopic study of the conjunctival blood vessels.** *Arch. of Ophth.*, 1946, v. 35, May, pp. 519-524.

The conjunctival vessels are readily available for study and provide the ophthalmologist with a unique opportunity to learn many of the details of the ocular circulation.

The conjunctival blood vessels can be examined in some detail with the usual slitlamp. However, even with the widest slit there is insufficient light, and much is lost. The slit beam is of little advantage in studying the conjunctival vessels. So much has been written of recent years concerning the value of the sharply focused slit beam of light that it seems to be going backward to remove the slit. However, conditions in the conjunctiva are very different from those in the pupillary zone. In the transparent media of the eye, the narrow focused slit beam of light is a splendid arrangement, while its illumination is near the upper limit of tolerance for most patients. However, on the conjunctiva a wider field of

illumination is advantageous, and higher intensities of light are easily tolerated. With the combination of more light and a larger field, much more becomes visible through the binocular microscope.

The conjunctiva is almost transparent, particularly in older persons, so that the blood vessels are easily seen. The red vessels are arranged in a thin layer against a contrasting white background. The walls of most of these vessels are so thin that they are barely discernible, whereas the blood cells circulating in them are visible. There is a conspicuous variation in many features of the circulation from vessel to vessel. In some there is a swift current, which flows evenly; in others the blood moves slowly and irregularly, and in still others the flow may even stop and be reversed in direction. In a few instances a pulsating movement synchronous with the heartbeat is observed. In some vessels there is a rushing and swirling of a turbulent stream. The aqueous veins, which were so named by Ascher because of their high aqueous content, are readily identified, and their course is easily traced. Delicate lymph channels can be identified in a few instances.

The modification of the slitlamp by which this examination is made possible is described. R. W. Danielson.

Haar, M. **Reiter's disease.** Acta Ophth., 1945, v. 23, pt. 2, pp. 143-150.

In rapid succession an 18-year-old boy developed conjunctivitis, bilateral iritis, prostatitis, and exudative polyarthritis. Gonorrhea was excluded, and the diagnosis of Reiter's disease was made. The eyes made a rapid recovery. The outstanding feature of the case was the pronounced exudation in the eye and joints.

Ray K. Daily.

Klar, R. **Corneal involvement in vernal conjunctivitis.** Klin. M. f. Augenh., v. 109, May-June, p. 385. (See Section 6, Cornea and sclera.)

Kove, Simon. **Stevens-Johnson syndrome (eruptive fever with stomatitis and conjunctivitis).** Am. J. M. Sc., 1945, v. 210, Nov., p. 611.

Two cases of Stevens-Johnson syndrome of unknown etiology and characterized by an eruptive fever with membranous stomatitis, purulent conjunctivitis, and severe constitutional reaction are reported. They were encountered within a 2½-week period with no history of contact with each other.

The first patient was treated with sulfadiazine orally in addition to local therapy and recovered completely. The other was desperately ill and was treated with both sulfadiazine and penicillin. After a protracted and extremely stormy course, the patient recovered completely except for a mild chronic residual conjunctivitis and bilateral synechiae.

The effect of either sulfonamide or penicillin therapy cannot be properly evaluated from a review of these two cases.

The etiologic agent may be related to the virus of mumps.

Theodore M. Shapira.

Nižetić, Z. **Swimming pool conjunctivitis or swimmers' (divers') conjunctivitis.** Klin. M. f. Augenh., 1943, v. 109, May-June, p. 320.

The term swimming pool conjunctivitis is misleading since it suggests that the infection is only acquired in closed artificial pools, which is not true. Epidemics have been observed in open bathing places such as the Black Sea and Lake Michigan. The author ob-

served six cases in the last two years. He proposes that it would be more appropriate to call the disease swimmers' or divers' conjunctivitis. F. Nelson.

Odegaard, Kristian. Purulent conjunctivitis with keratitis caused by *Neisseria intracellularis* (meningococcus). *Acta Ophth.*, 1944, v. 21, pt. 4, pp. 295-302.

A case of primary meningococcus kerato-conjunctivitis in a hospital maid is reported. Clinically the course resembled gonorrheal ophthalmia. Isolated meningococcus conjunctivitis is rare and some of the reported cases were complicated with meningitis. The diagnosis can only be made from a culture, and it is suggested that some of the cases diagnosed from smears as gonorrheal ophthalmia might have been meningococcus conjunctivitis.

Ray K. Daily.

Osterline, Gote. An investigation into the presence of lymphatic tissue in the human conjunctiva and its biological and clinical importance. *Acta Ophth.*, 1944, supplement 23, pp. 77.

The material for this study consisted of the conjunctivas of 92 persons varying in age from the newborn to 81 years. Most of them died within 24 to 48 hours following violent trauma. The conjunctiva was dissected from the tarsus and globe and stained in a solution of gallocyanine, which stains the follicles bluish black so that they can be counted under a binocular loupe. These counts and the histologic data show that the conjunctiva of the newborn is free from follicles. Follicles begin to form in early infancy and reach the maximum of 30 follicles in eyes about the age of eight years. At the age of 15 years their number begins to dwindle and at 25 to 35 years of age.

their average number is 10. After this age their number varies but little. Up to 15 years of age all subjects had follicles. As the subjects get older one encounters more and more without follicles. In childhood, the follicles are larger and more numerous in the upper conjunctival fold. With the age of the patient they become smaller and more evenly distributed. Microscopically the conjunctival nodules are similar in structure to lymphatic nodules elsewhere in the body. Biologically they are centers of reaction to external irritants. Their task is to participate in the defense of tissue against bacterial and toxic irritants. Correlating the number of follicles with the extent of conjunctival inflammation it appears that follicles are very rarely formed in a conjunctiva which is free from irritation; they were found in declining form in two out of 23 such membranes. Follicle formation is primarily associated with slight or subsiding inflammatory processes, too mild to produce marked clinical symptoms. There is no follicle formation in acute conjunctivitis. These findings indicate that folliculosis of the conjunctiva can not be differentiated into different types etiologically or morphologically, and that in all cases the follicles will eventually disappear spontaneously leaving no scars. (10 illustrations, 4 tables.)

Ray K. Daily.

Pavisc, Z. Early transplantation of mucous membrane from the mouth and conjunctiva in burns of the eye. *Ophthalmologica*, 1944, v. 108, Dec., pp. 297-304.

The author advocates early transplantation of mucous membrane in severe cases of cauterization and burns of the conjunctiva and cornea. When both eyes are affected he uses mucous

membrane from the mouth. When only one eye is damaged, conjunctival tissue from the upper fornix of the undamaged eye can be used if the burn is not too extensive. In several patients early transplantation only prevented a more marked symblepharon and did not prevent corneal leucoma, but in several others normal vision was preserved. The latter was especially true after acid burns. Max Hirschfelder.

Poulsen, A. G. **A case of melanocarcinoma conjunctivae.** Acta. Ophth., 1945, v. 23, pt. 2, pp. 151-160.

The literature is reviewed and a case reported in a 23-year-old woman. The growth recurred twice and microscopic examination after the third excision revealed the growth to be a melanocarcinoma. The clinical as well as the histological differential diagnosis between a benign and malignant naevus is difficult, and all conjunctival naevi should be considered as an intermediate stage between normal tissue and actual tumor tissue. Suggestive of transition into malignancy is the location at the temporal limbus, increased pigmentation and growth, vascularization from peripheral vessels, adhesion at the base, inflammatory symptoms, ciliary pain, recurrence after excision, and occasionally iritis. (Photomicrograph.)

Ray K. Daily.

Radnót, M. **Bacteriologic findings in gonorrheal conjunctivitis treated with sulfa drugs.** Klin. M. f. Augenh., 1943, v. 109, May-June, p. 344.

When sulfamid drugs are used in the treatment of ophthalmoblennorrhea, gonococci often disappear from the conjunctival sac in a few days. Occasionally gonococci can be found for a long time after clinical cure. Certain precautions are imperative to prevent recur-

rence and transmission of the disease by these carriers. Before discharge three smears taken at intervals of 48 hours should be negative. Gram staining should be used to avoid confusion with staphylococci which often resemble diplococci, although it is believed that some gonococci become Gram-positive during the administration of sulfa drugs. The final bacteriological examination should be carried out after the disappearance of clinical symptoms and after the patient is free from sulfa drugs. (References.)

F. Nelson.

Skydsgaard, Henning. **Polyarthritidis urethritica simplex with eye symptoms.** Acta Ophth., 1943, v. 21, pts. 1-2, pp. 107-118. (See Section 17, Systemic diseases and parasites.)

Sorsby, Arnold. **Ophthalmia neonatorum in England, 1844-1944.** Sight-saving Review, 1945, v. 15, Winter, pp. 187-196.

In 1844 more than 30 percent of all blind children lost their sight through ophthalmia neonatorum; in 1928 it was 28.5 percent and in 1944 not more than 9.2 percent. Three factors that brought about the decline are the Crede technique, compulsory notification of the disease, and the use of sulfonamides. The latter has been replaced by penicillin. A solution containing 2500 units per c.c. is recommended at half hour intervals although in the last seventy-two patients at White Oak hospital one drop of penicillin was instilled every minute. The formation of pus stopped in one half hour and the residual catarrhal conjunctivitis disappeared in two or three days. Ophthalmia neonatorum is not synonymous with gonococcal ophthalmia. Of 737 cases, 180 were caused by gonococcus, 271 by the vari-

ous types of staphylococcus, 119 cases by bacilli, and in 126 cases no organisms were found. Fifteen percent of all cases appeared to be caused by a virus.

I. E. Gaynon.

Ulrich, K. **Chemo-therapeutic treatment of gonorrhea.** *Klin. M. f. Augenh.*, 1943, v. 109, May-June, p. 347.

Thirteen infants with gonoblennorrhea neonatorum were given the sulfa drug orsulon. In 11 infants the eyes recovered completely in three to five days. One infant developed slight cyanosis. In another, a very feeble baby who could not tolerate the drug, the process was not influenced greatly. Recovery was slow and complications occurred in infants who were not breast-fed or were given only small amounts of mothers' milk. Only one of the 13 infants developed a corneal infiltration, which healed rapidly. Local treatment is unnecessary. (References.)

F. Nelson.

Vanýsek, J. **Conjunctivo-urethrosynovial syndrome of Fiessinger and Leroy or Reiter's disease.** *Časopis Lékařů Českých*, 1946, v. 85, March 15, pp. 343-347.

Several cases of conjunctivitis with arthritis and urethritis were observed during an outbreak of infectious keratitis. This disease, called Reiter's disease, usually follows an attack of diarrhea. Reiter claimed that he was successful in isolating a spirochete, which he called *Spirochete forans*, from the secretions. Fiessinger and Leroy, however, stated that the disease is a sequel of bacillary dysentery. The author observed seven patients with conjunctivitis and superficial punctate keratitis, in three of whom there was also iridocyclitis. Urethritis and arthritis were present in all patients. The illness

started after diarrhea. It lasted three weeks and longer. No gonococci and no spirochetes were found. While the bacteriologic diagnosis of bacillary dysentery was not established, the author believes that in the patients observed by him the syndrome was a complication of dysentery, which was prevalent at that time.

O. Felsenfeld.

Wain, Harry. **Ophthalmia Neonatorum—A historical résumé and present status in the United States.** *Sight-Saving Review*, 1945, v. 15, Winter, pp. 196-202.

The author discusses ophthalmia neonatorum from the point of view of gonorrhea. He describes the disease, its history in the United States, the Crede technique, and makes a plea for the eradication of the disease in the mother before the birth of the child. The incidence of blindness due to ophthalmia neonatorum has dropped from 30 to 2.4 percent.

I. E. Gaynon.

6

CORNEA AND SCLERA

Becker, F. **The etiology and therapy of epidemic keratitis.** *Klin. M. f. Augenh.*, 1943, v. 109, May-June, p. 412.

In the treatment of epidemic keratitis (nummularis) the use of Greifswald dye solution and subsequent treatment with 0.5 to 1-percent salicylic acid solution and 10-percent zinc oxide ointment yielded very gratifying results. The same ointment was also administered successfully in a case of a severe post-traumatic herpes of the cornea.

F. Nelson.

Bedell, A. J. **Epidermoid carcinoma of the cornea.** *Amer. Jour. Ophth.*, 1946, v. 29, July, pp. 864-866. (5 figures.)

Chamberlain, W. P. and Boles, D. J. **Edema of cornea precipitated by quinacrine (atabrine).** Arch. of Ophth., 1946, v. 35, Feb. pp. 120-134.

Six cases of corneal edema following the use of quinacrine (atabrine) were observed in the Southwest Pacific area. Four of the patients are described in considerable detail. Each patient had been taking protective doses of quinacrine, from 0.1 gm. to 0.2 gm. of the drug, for several weeks before the onset of symptoms. Visual acuity was variable. There was diffuse haziness of the corneas due to evenly dispersed punctate, superficial opacities. Withdrawal of the drug resulted in gradual clearing of the opacities. Resumption of the use of the drug resulted in a reappearance of the edema. All four of the cases studied intensively showed some liver damage, and one of the patients died of hepatic necrosis.

John C. Long.

Friede, R. **The nature of congenital corneal degeneration.** Klin. M. f. Augenh., 1943, v. 109, May-June, p. 390.

Dystrophy of the cornea is a disease that is essentially congenital but becomes manifest during postnatal life.

Bückler described three readily distinguishable types. Friede observed a number of cases of congenital corneal dystrophy over a period of 20 years and investigated the heredity of the process of the various types. The type of heredity is recessive. In some patients remissions of more than 10 years duration occurred between the thirtieth and fiftieth year of life. The first opacities were always found near Bowman's membrane and the anterior layers of the stroma. The middle and posterior layers at the corneal periphery became involved later. Exceptions to this rule were rare. Most details concerning nu-

trition of the cornea are not yet known. The intake of nutrient material may take place through the limbus and its capillaries, through the posterior vitreous membrane and its endothelium and through the anterior vitreous membrane and its epithelium. Lesions of the anterior as well as the posterior barrier must lead to swelling and eventually to clouding of the corneal stroma. The water content in the stroma is kept constant though it is exposed to the aqueous barriers, but only if these structures are intact and their function is not impaired. The chemical structures in endothelium and epithelium on the one hand and in the stroma on the other are quite different. The epithelium forms an acid covering over the alkaline stroma. Bowman's membrane and its epithelium probably serve as filter. The functions of the vitreous membranes have not been investigated sufficiently but much may be surmised. In the congenital corneal dystrophies the most serious change takes place in the anterior vitreous membrane. A disturbance of filtration in that membrane occurs. The involvement of Bowman's membrane seems to be the primary process and that of Descemet's membrane the secondary. The other vitreous membranes of the eye never participate in the pathological process. It is probable that the disease is a local process rather than a general one. Friede is inclined to believe that all three types of congenital corneal dystrophy are caused by the same agent, namely a disturbance of the metabolism of Bowman's membrane and epithelium. The differences of clinical appearance and development of the various opacities may be caused by congenital differences in the structure of the stroma. The hyaline of which the

opacities in dystrophic corneas consist is probably caused by a chronic retention of certain substances which eventually leads to disintegration of the tissues and to permanent opacities in epithelium, vitreous membrane and stroma. (Bibliography.) F. Nelson.

Friedenwald, J. S., Hughes, W. F., Jr., and Herrmann, H. **Acid burns of the eye.** *Arch. of Ophth.*, 1946, v. 35, Feb., pp. 98-108.

The following acids, in buffered and non-buffered solutions, were tested on the rabbit cornea: hydrochloric, trichloroacetic, metaphosphoric, sulfosalicylic, picric, tungstic, and tannic. Clinical reactions produced by solutions of these acids on the rabbit cornea were studied over a pH range of 1 to 9.

Acid burns of the eye are essentially nonprogressive, and late relapses are uncommon. The severity of the lesion produced is directly related to the protein affinity of the anion. Anions with high protein affinity and protein-precipitating ability produce corneal lesions at a higher pH than anions with low protein affinity. Large anions with high protein-precipitating ability show poor penetration through the corneal epithelium and poor diffusibility in the stroma. It is suggested that the characteristics of acid burns of the cornea may be explained by the precipitation and denaturation of the proteins of the cornea. (7 photomicrographs.)

John C. Long.

Fieandt, Olaf. **A histologically examined case of corneal transplantation.** *Acta Ophth.*, 194, v. 22, pt. 1, pp. 36-43.

An eye with vision reduced to hand movements as a result of parenchymatous keratitis was treated by a corneal transplantation. The eye subsequently developed an anterior cham-

ber cyst, and was enucleated. The histologic picture of the transplanted cornea supports the claim of those who consider the transplanted cornea as a permanent transplant and not merely a scaffold for regenerative processes, as is claimed by Salzer and Löhlein. The transplanted area contained all the corneal layers. Bowman's membrane, present in the transplant, was partially absent in the surrounding cornea and completely absent at the margin of the transplant. Descemet's membrane was thinner in the transplant. The literature is reviewed. (5 illustrations.)

Ray K. Daily.

Gallenga, R. and Rossi, A. **Early relief of corneal affections with plesiotherapy (contact radiation).** *Rassegna Ital. d'Ottal.*, 1946, v. 15, no. 1 and 2, p. 7.

The authors report excellent results in ulcerous keratitis of various types, pannus, recent corneal opacities, and especially in herpetic keratitis. The optimum dose of radiation was 400 r, with a tension of 60 kVm and a 0.5 mm. copper filter. Working with 3 Ma at a focal distance of 6 cm., 100 r was administered per minute with the Gorla Siana instrument. The treatment is given daily for one week in acute inflammations, and the course is repeated in subacute and chronic conditions.

The best results were obtained in herpetic keratitis where corneal sensibility returned rapidly, proliferation of superficial vessels was checked, and congestion decreased.

Eugene M. Blake.

Grosz, Stefan. **A new remedy for the treatment of phlyctenular keratitis.** *Acta Ophth.*, 1944, v. 22, pt. 3, pp. 275-280.

The author found a 15-percent sodium irgamid (N-Dimethylacroyl-

Sulfamid) ointment to be non-irritating and well tolerated in phlyctenular conjunctivitis in children. It is particularly indicated in eyes which do not tolerate yellow oxide of mercury, and can be combined with the internal administration of iodine. Its action is attributed to vasoconstriction. Ray K. Daily.

Holt, M. and Cogan, D. G. **The cornea.** Arch. of Ophth., 1946, v. 35, March, pp. 292-298.

In connection with recent studies of the permeability and other properties of the excised cornea, Holt and Cogan thought that measurements of electrical impedance might be expected to give additional pertinent information. It is now generally accepted that the impedance of biologic tissues is directly related to their ionic permeability. In the same way that measurements of impedance of solutions of pure electrolytes may be considered to measure (aside from concentration effects) the ability of the ions to diffuse through the medium, measurements of impedance of the cornea may be considered to give a measure of the ability of the ions to move through this tissue.

The authors used the corneas of beef eyes and came to the following conclusions.

Electrical impedance of the excised cornea is considerable as long as the epithelium is present. The impedance of the stroma alone is slight. So far as impedance is an index of ionic permeability, this means that the epithelium offers considerable resistance to the passage of ions, whereas the stroma offers a resistance little more than that offered by an equivalent volume of isotonic solution of sodium chloride.

The corneal epithelium is an even

more effective semipermeable membrane than previous chemical measurements have shown it to be.

The impedance of the epithelium of the excised cornea is irreversibly decreased by bathing the cornea in a 25-percent solution of sodium chloride; it is unaffected by a 0.9-percent solutions of sodium chloride, calcium chloride, and sodium nitrate, and it is reversibly increased by a 10-percent solution of atropine sulfate, by a 4-percent solution of cocaine hydrochloride, and, especially, by solutions in which the cation is the potassium ion.

R. W. Danielson.

Jancke, G. **Cibazol treatment of keratoconjunctivitis nummularis epidemica and of other eye diseases.** Klin. M. f. Augenh., 1943, v. 109, May-June, p. 314.

Jancke reports most satisfactory results in the treatment of keratoconjunctivitis nummularis with 10-percent cibazol eye ointment twice daily. When the disease is severe it is necessary to give scopolamine regularly, and when extreme, one has to resort to intensive peroral administration of cibazol. Other infectious eye diseases such as corneal ulcers, dacryophlegmon, orbital phlegmon, and erysipelas respond well to intensive therapy. It can also be applied as an adjuvant in intraocular infections. It seems that trachoma can be cured by oral administration of cibazol alone. Combined with customary mechanical methods this is the shortest possible type of treatment of trachoma. (References.)

F. Nelson.

Kiehle, F. A. **Scleromalacia.** Amer. Jour. Ophth., 1946, v. 29, July, pp. 862-863. (References.)

NEWS ITEMS

Edited by DONALD J. LYLE, M.D.
904 Carew Tower, Cincinnati 2

News items should reach the editor by the twelfth of the month

DEATHS

Dr. Benjamin George Dyer, Kalamazoo, Michigan, died May 15, 1946, aged 80 years.

Dr. Alan Fesch Knisely, Lima, Ohio, died June 12, 1946, aged 87 years.

Dr. John Alexander McCaw, Denver, Colorado, died March 28, 1946, aged 79 years.

Dr. Howard Wilber Peirce, Detroit, Michigan, died April 17, 1946, aged 65 years.

MISCELLANEOUS

Dr. Placidus J. Leinfelder, professor of ophthalmology, Iowa State University, was a member of the faculty committee which, after several months' study, recommended a two-year experimental plan for faculty compensation in the College of Medicine, Iowa City.

The plan, recently approved by the Iowa State Board of Education, adopts a salary schedule for the various professional ranks in medicine. Private clinical practice was authorized, with percentage limits based on individual salaries. Fees from private patients will be credited to the clinical department giving the service. From this income, the faculty doctors will be paid the additional stipulated percentage of their basic salaries. Funds remaining will be used for departmental equipment and scientific programs. Professors desiring to serve on a full-time basis will, as in the past, be permitted to do so.

Preliminary steps were put into effect immediately, according to the report published in the Iowa City Citizen of July 25th, and the plan will be in full force by July 1, 1947. After a two-year trial, the plan will be reviewed by the university authorities in consultation with the faculty of medicine.

The Army Institute of Pathology is in the process of undergoing a considerable expansion and change of organization. It will still continue to be the Institute of Pathology for the United States Army, but it will also function for the Veterans' Bureau and play an expanded role in the activities of the civilian profession.

On request of Major Gen. Norman T. Kirk, Surgeon General of the Army, the committee on pathology of the National Research Council, Division of Medical Sciences, late in 1945, prepared a report on the future development of the Institute. The report has been approved by the Surgeon General and by the War Department.

The essential recommendations in this report

are: (1) that a new building of adequate size be constructed; (2) that the Institute be organized in four divisions—Department of Pathology, Army Medical Illustration Service, Army Medical Museum, and American Registry of Pathology—each headed by a competent specialist; (3) that the staff of the Institute be drawn from both the commissioned ranks of the Army and from the civilian professions; (4) that a comprehensive educational and training program be undertaken; (5) that the vast store of material at the Institute be used for research; (6) that the services in pathology in the Veterans' hospitals be centralized at the Institute.

The American Registry of Pathology founded in 1922 thus is, and will continue to be, an integral part of the Army Institute of Pathology. There were, on January 1, 1946, over 43,000 cases registered. To effectuate the new plans as they relate to the Registry, the National Research Council, Division of Medical Sciences, appointed a committee on the American Registry of Pathology. The members of the committee are Howard T. Karsner, chairman, Cleveland; Col. J. E. Ash, Washington; Brig. Gen. R. Callender, Washington; Col. Baldwin Lucké, Philadelphia; Robert A. Moore, Saint Louis; Benjamin Rones, Washington; A. R. Shands, Jr., Wilmington; and Henry A. Swanson, Washington.

At the present time there are 14 registries as parts of the American Registry of Pathology. These include Registry of Ophthalmic Pathology, established in 1922, sponsored by the American Academy of Ophthalmology and Otolaryngology; Lymphatic Tumor Registry, established in 1925, sponsored by the American Association of Pathologists and Bacteriologists; Bladder Tumor Registry, established in 1927; Kidney Tumor Registry, established in 1940, and Prostatic Tumor Registry, established in 1943, sponsored by the American Urological Association; Registry of Dental and Oral Pathology, established in 1933, sponsored by the American Dental Association; Registry of Otolaryngological Pathology, established in 1935, sponsored by the American Academy of Ophthalmology and Otolaryngology; General Tumor Registry, established in 1937, sponsored by the American Society of Clinical Pathologists; Registry of Dermal Pathology, established in 1938, sponsored by the American Academy of Dermatology and Syphilology; Chest Tumor Registry,

established in 1942, sponsored by the American Society of Thoracic Surgeons; Registry of Neuropathology, established in 1943, sponsored by the American Association of Neuropathologists; Registry of Orthopedic Pathology, established in 1943, sponsored by the American Academy of Orthopedic Surgeons; Registry of Veterinary Pathology, established in 1944, sponsored by the American Veterinary Medical Association; and Registry of Gerontology, established in 1945, sponsored by the Gerontological Society, Inc.

Plans for additional registries are under consideration. A professional scientific society wishing to sponsor a registry should communicate with the Director, Army Institute of Pathology, 7th Street and Independence Avenue, S.W., Washington 25, D.C. The society appoints a committee to work with the Director in supervision of the activities of the Registry, and makes an annual contribution to the budget which is administered by the National Academy of Sciences.

All specimens in the Registry are available for review and research by competent investigators. Sets of slides and accompanying syllabuses on special fields are available for loan to the civilian professions and to officers in the Federal services. Physicians, dentists, and veterinarians are urged to send unusual specimens together with an abstract of the history to the Registry. The contributor receives a report on each specimen and is asked to keep the Registry informed of the follow-up on the patient.

Many diseases are so rare that any one individual or even the staff of any one hospital or clinic has a limited opportunity to study certain conditions and lesions. Conclusions in science must be based on not one, but many observations. Therefore, it is desirable to organize and support central agencies for the collection and filing of histories, specimens, and follow-up studies.

With the reorganization of the Army Institute of Pathology to be completed during 1946 and 1947, a full-time scientific director of the American Registry of Pathology will be appointed and sufficient clerks and technicians will be available to assure adequate use of the registries for diagnosis, research, training of young men, and education of the professions.

The American Registry of Pathology deserves support from the civilian professions in terms of contributions of materials by individuals and sponsorship of registries by societies.

The Ophthalmological Study Council is planning another course of lectures (this time with some laboratory work) to be given this winter, November 2nd to January 15th in St. Petersburg, Florida, by a very exceptional group of lecturers from all over the United States. Like the first course, this one will be devoted to the

basic subjects of Ophthalmology: Anatomy, Histology, Embryology, Heredity, Physiology, Biochemistry, Optics, Physiological optics, Pathology, Histopathology (including laboratory work with microscopes), Bacteriology, Refraction (theoretical and practical), Motility, Neuro-ophthalmology, Slitlamp (theoretical and practical in four sections), Surgical principles, Relations to general diseases, and Glaucoma (from all points of view). There will be over 360 hours of instruction. The fee is \$300.

Arrangements can be made to take special subjects either singly, or two or three at a time, when they are given simultaneously in alternating periods. For instance: Biochemistry by Kinsey, Optics by Lancaster, and Visual physiology by Linksz can be taken during 10 days. Glaucoma by Chandler and Medical ophthalmology by Wagener can be taken during one week. Motility by Burian and Refraction by Beach, Regan, and Lancaster can be taken during another 10 days. Pathology with microscopes, and laboratory work on Optics and on Physiology can be taken from December 21st through December 31st. Fees depend on the number of periods; the average is about \$40 per week.

First class hotel accommodations are from \$4 per day, single, to \$6 per day, double. Round trip rates by coach are very low. For example: Boston to St. Petersburg and return costs \$60.82 plus tax.

The 20th annual spring graduate course in ophthalmology and otolaryngology will be held at the Gill Memorial Eye, Ear, and Throat Hospital, Roanoke, Virginia, April 7 to 12, 1947.

SOCIETIES

The program for the Association of Military Surgeons, Eye, Ear, Nose and Throat panel discussion, October 11, 1946, at the English Room, Statler Hotel, Detroit, Michigan, follows:

Morning, 9 o'clock

Comdr. A. Duane Beam (MC), U.S.N.R., Detroit, Michigan. "Traumatic injuries of the eyes and their repair."

Lt. Col. James N. Greear (MC), A.U.S., Washington, D.C. "Rehabilitation of the blind."

Lt. Col. Gilbert C. Struble (MC), A.U.S., Valley Forge General Hospital, Phoenixville, Pennsylvania. "Repair of eye injuries" (Movie).

Lt. Col. E. L. Shiflett (MC), A.U.S., William Beaumont General Hospital, El Paso, Texas. "X-Ray reconstruction of orbit as an aid to surgical reconstruction."

Lt. Col. Ben. H. Senturia (MC), A.U.S., Saint Louis, Missouri. "Ear plugs for the prevention of deafness."

Lt. Col. Edmund P. Fowler (MC), A.U.S., New York, New York. "Irradiation of the eustachian tubes."

Afternoon, 2 o'clock

Lt. Col. Mercer G. Lynch (MC), A.U.S., New Orleans, Louisiana. "Laryngeal injuries and their repair."

Capt. Francis L. Lederer (MC), U.S.N.R., Chicago, Illinois. "Rehabilitation of the deaf in the Navy."

Lt. Col. Frank D. Lathrop (MC), A.U.S., Boston, Massachusetts. "Facial nerve repair due to war injury."

Dr. Julius Lempert, New York, New York (by invitation). "Lempert fenestra novovalis operation for the restoration of practical serviceable hearing in clinical otosclerosis" (motion picture of technique).

Honorary chairmen: Maj. Gen. Norman T. Kirk (MC), U.S.A., and Vice Adm. Ross T. McIntyre (MC), U.S.N.

PERSONALS

At the exhibit of the American Physicians Literary Guild held in San Francisco in conjunction with the A.M.A. convention, Dr. Joseph I. Pascal was awarded first prize for a humorous essay "If you must wear glasses—wear invisibles."

Dr. James C. Strong, recently released from Service, announces the opening of his office, 617 Majestic Building, Denver 2, Colorado.

Dr. Alston Callahan, professor of ophthalmology, Medical College of Alabama, announces the opening of his office, 908 South Twentieth Street, Birmingham, Alabama.

Dr. John C. Cunningham, 49 South Winooski Avenue, Burlington, Vermont, has been named chairman of the department of ophthalmology at the College of Medicine, University of Vermont, Burlington.

On November 21, 1946, Dr. Algernon B. Reese will deliver the deSchweinitz Lecture before the Section on Ophthalmology of the College of Physicians, Philadelphia.

Dr. Adalbert Fuchs of Vienna wishes to let his friends and colleagues in the United States know that he and Mrs. Fuchs have accepted employment with UNRRA and that, until further notice, his address will be: Headquarters, UNRRA, Shanghai, China.

ERRATA

The obituary of Dr. James Watson White which was published in the August issue of the Journal was prepared and written by Dr. Harold Whaley Brown, an associate of the late Dr. White.

CHEMICAL BURNS OF THE HUMAN CORNEA

RALPH S. McLAUGHLIN, M.D.
Charleston, West Virginia

A chemical burn of the cornea is defined as an injury which results from local contact with a chemical (solid, liquid, or vapor) to such a degree that there is alteration in the structure of the cornea and the conjunctiva. This alteration in structure is demonstrated by a positive stain when a 2-percent buffered solution of fluorescein is applied.

It has been the experience of the author to have practiced industrial ophthalmology in an industrial center where a large variety of chemicals is manufactured and utilized. These include particularly many of the newer solvents, plastics, alcohols, aldehydes, and hydrocarbons, as well as the intermediates involved in their manufacture. The observations discussed in this paper have been made through association with such establishments as Carbide and Carbon Chemicals Corporation, American Viscose Corporation, Westvaco Chlorine Products Corporation, Monsanto Chemicals, Ohio-Apex, and Belle Alkali Companies. The Carbide and Carbon Chemicals Corporation alone manufactures and ships over 200 different chemical compounds from their local operations, and it has been this firm which has sponsored and aided the present study. A companion paper¹ is presented on adjoining pages by the Chemical Hygiene Fellowship at the Mellon Institute, Pittsburgh, which is supported by that corporation. That communication presents a tabulation of

some 180 chemicals arranged according to the severity of injury they produce on the cornea of the albino rabbit, together with studies of burns of the rabbit cornea which have thrown light upon clinical observation.

The magnitude of the problem in one plant is shown by the data in Table 1. Each one of the patients in the cases listed was known to have had a chemical

TABLE 1
EXPERIENCE OF ONE PLANT WITH CHEMICAL EYE
IRRITATIONS AND BURNS, EXCLUSIVE OF
TRAUMATIC INJURY

Year	Dispensary Cases	Referred Cases
1942	663	85
1943	583	69
1944	926	82
1945	1,394	97
Totals	3,566	333

cal exposure which was at least severe enough to bring the employee to the dispensary, complaining of his eyes and requiring treatment. As can be seen, only 10 percent of the injuries were severe enough to be referred to the ophthalmologist, and, in this particular group, only one case was terminated with a loss of vision. In all of those treated in the dispensary, there was complete recovery. In a recent tabulation for 12 months in the same establishment, it was found that 52 percent of the chemical eye injuries were caused by vapors and mists,

31 percent by liquids, and 17 percent by solids. In due respect to the Safety Department of the corporation, it should be remembered that during a great portion of the period the plant was operating under wartime conditions with inexperienced, and in some cases inefficient, help, due to loss of regular employees to the Armed Services.

Every endeavor has been made to cooperate closely with plant Safety and Medical Departments in order to maintain an adequate program for the prevention and treatment of chemical burns of the eye.

FIRST-AID TREATMENT

Over the period of seven years covered by this study, it has been determined, beyond question of doubt, that early

following program has been accomplished, during this period, by Dr. Thomas W. Nale,³ medical director of the South Charleston Operation of the Carbide and Carbon Chemicals Corporation, and by me. The results obtained lead us to believe that the following technique is most desirable:

The immediate treatment of an eye burn is at the site of the accident. Specially built foot-operated eyewashing fountains are provided close at hand in every working area (fig. 1). The injured eye is washed thoroughly and at once with tap water, holding the lids open with the hands. No neutralizing substances are used, since study¹ of this practice reveals that not only do they do no good but that actually some are injurious in themselves. After the preliminary washing, the victim is at once transported to the medical dispensary, where equipment for first aid is held ready at all times.

A list of chemicals used in the plant is maintained in each dispensary. This list sets forth the severity of injury expected, and the acidity, alkalinity, or neutrality of any chemical in question. The more frequently used chemicals were evaluated on the basis of experiments made in rabbits' eyes.¹ A similar list is in the hands of the ophthalmic consultant, so that he may have some basis for judging in advance the therapeutic measures called for.

When a chemical eye burn is brought into the dispensary, the patient is placed in a reclining chair (Beck) and tilted back over a catch basin. The eye is inspected and then anesthetized with 0.5-percent pontocaine solution. Gross particles are removed with a moist cotton applicator. The eye is then irrigated with a continuous flow of normal saline, no pressure being exerted on the eye. Special equipment (figs. 2 and 3) consists



Fig. 1 (McLaughlin). Eye-washing fountain installed in a chemical unit. 1, Soft rubber eye piece; 2, foot peddle to control water flow.

treatment is of supreme importance to the ultimate outcome of a chemical burn of the eye.² Development of the

of a 5-gallon bottle mounted on a movable stand and equipped with a siphon (3-foot head). Irrigation is continued for 15 minutes, after which the eye is reexamined for gross particles and then stained with fluorescein. If the eye is damaged, the injured cells will take a typical fluorescent yellow-green stain. If a stain is observed, further anesthesia is produced with pontocaine, and washing proceeds for another 15 minutes. The stain is applied a second time and, if found to be positive, the case is considered to be an unequivocal chemical burn and is referred to the ophthalmologist. Time, here, is of importance, and it has been my experience that no more than two hours should elapse between the moment of the burn and the time when special treatment is rendered. Certainly, the prognosis grows worse as time passes, and a delay of six hours almost always results in some loss of vision.

It is possible to get moderately severe burns from vapors alone. In cases of vapor irritation, the same technique of emergency treatment is used as for other burns, except that it is not necessary to wash the eyes for as long, unless there is a demonstrable staining of the cornea. In all cases where washing is reduced to the first 15 minutes, a recheck of the eye is made with stain in two hours, and the patient is warned to report at once should any untoward symptoms develop in the suspected eye. This is done because a few chemicals have been observed to cause a delayed injury, producing a breakdown of corneal epithelium some hours after contact.

DENUDING, A SPECIALIZED TECHNIQUE

When I began the study of chemical burns of the eye, seven years ago, it was a debatable question whether or not some chemicals had a "delayed action." Such compounds frequently caused a loss

of vision due to opacification of the cornea and adhesions of the conjunctiva, following a symptom-free period of several hours after accidental contact. In searching for a scientific basis for this behavior, the most notable finding was the change in corneal structure produced by all alkaline and a few neutral organic compounds, but not by acidic compounds nor those neutral chemicals which experience shows to be relatively harmless.

The corneal structure is best observed with the high power of the biomicroscope under retroillumination,⁴ with occasional resort to direct illumination. The change consists in the presence of areas of opacity in the superficial layers of the corneal epithelium. They vary in size, possess a grayish tint, and have well-defined margins. They suggest keratitic deposits, but direct illumination reveals them to lie immediately posterior to the precorneal film⁵ in the most superficial epithelial layers anterior to Bowman's membrane. The opaque areas are seen to be stained a faint green by fluorescein when observed by direct illumination.

We at first thought that the offending chemical had penetrated into the epithelial cells, there reacting with the cytoplasmic protein. However, this would bind the chemical in place and probably neutralize its ability to injure other cells. Studies reported by Carpenter and Smyth¹ make it appear more probable that the foreign compound initially is physically adsorbed upon protein structures of the corneal epithelium. Following this, a portion of the adsorbed chemical denatures cellular protein, resulting in necrosis. The remainder is liberated slowly with its chemical nature unchanged, to diffuse from the original site of adsorption into previously unaffected tissue. Therefore, instead of a delayed effect, there is a progressive action which may spread to involve the entire depth of the epithelium

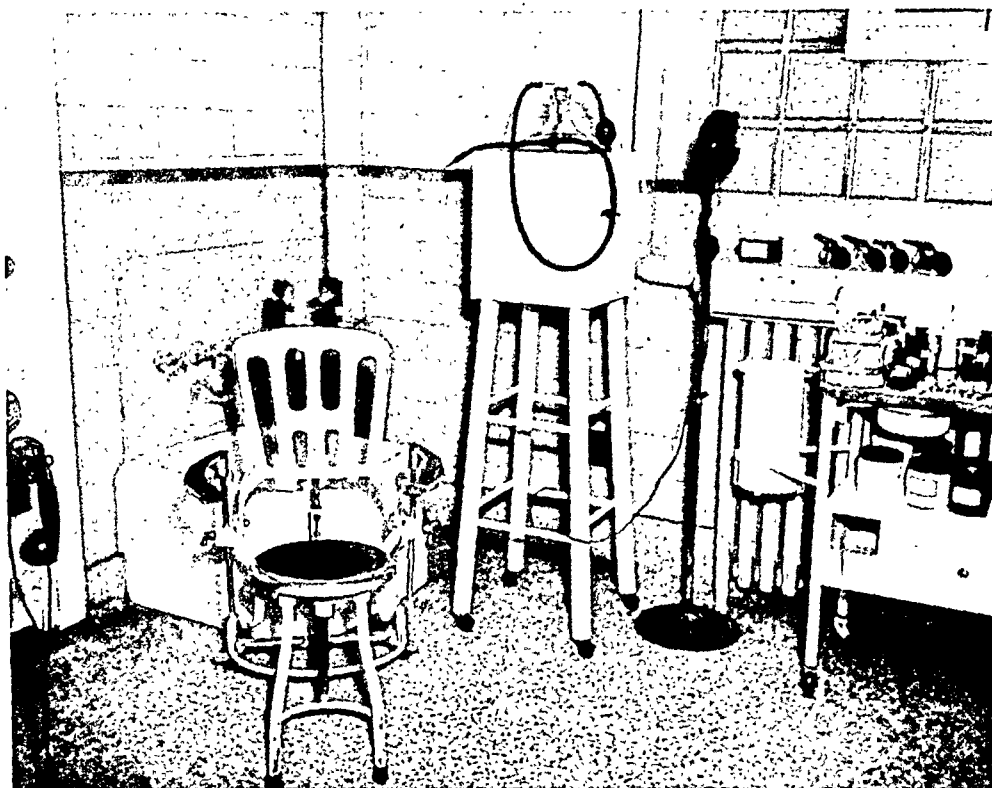


Fig. 2 (McLaughlin). Equipment utilized in irrigating chemical burns to the eye.

and, eventually, Bowman's membrane, at which point irreparable damage to the tissue results.

The greater number of chemicals behaving in this way are alkaline, and at first it appeared that neutralization of the compound bound to corneal epithelium would halt the progressive action. However, animal experiment¹ demonstrated no amelioration of injury from attempted neutralization. It was then apparent that only one form of treatment was possible, that of mechanical removal of the involved cells before a progressive action could be initiated. This operation is named "denuding." As carried out by me, the manipulation differs in purpose and thoroughness of control from débridement.

No evidence for a progressive action of acids has been observed. They apparently react rapidly with cell proteins, coagulating them, and themselves being

neutralized in the process. The extent of an acid burn of the cornea is, of course, determined by the amount and concentration of acid in the eye and the length of time that elapses before it is washed out. The method generally used in treating an acid burn is to débride the dead tissue and treat the eye symptomatically. Following the appearance of the communication by Mann⁶ on corneal healing, the author employed clinically the methods described and concluded, in conflict with her findings, that the course of healing is not prolonged by removing destroyed tissue. Furthermore, its removal reduces secondary infection by eliminating the substrate for bacterial growth. Consequently, I still consider débridement essential following corneal burns caused by acids.

The denuding technique in its early application consisted of complete removal of the epithelium down to Bowman's

membrane. The biomicroscopic picture of the completely denuded Bowman's membrane is that of a smooth surface, without evident cellular structure, having regularly placed, minute dimples which are the rami perforantes⁷ of the corneal nerves. Although we have later shown that such radical removal of tissue is unnecessary, we do know that the epithelium is rapidly replaced, and we have seen indication that the two methods of regeneration described by Mann⁶ are correct.

Denuding, as used today, removes only such part of the tissue as is involved, and the manipulation is controlled by repeated examination with the biomicroscope. The instrument of choice is a round tooth pick wound with cotton in the nature of a swab. The epithelium is softened with 4-percent cocaine-hydrochloride solution, which also acts as a local anesthetic. The applicator is started in the center of the involved area with just enough pressure to distort slightly the corneal surface. With a circular motion, the applicator is carried progressively from the center to the outside of the area, where it is lifted. This action is repeated over the entire affected area until the biomicroscope reveals no more of the clouded cells, but only a rough surface indicative of ruptured cell bodies and fragments of cells. After the corneal denuding is completed, a careful denuding of the conjunctiva is performed. Here the applicator is passed from the limbus to the cul-de-sacs, each lid swept from side to side, and the cul-de-sacs finally swept. The eye is then flushed with stainless solution of merthiolate, which acts not only to remove the denuding refuse, but also as an antiseptic.

Study of the eye during the denuding process may be confusing, for the pre-corneal film has been removed and allowance must be made for its absence. In

the final check on the biomicroscope, the meniscus of the lacrimal fluid where it meets the lower lid should be observed carefully, and no cellular debris should be left. Each eye is routinely closed with 5-percent sulfathiazole ointment (sulfa-



Fig. 3 (McLaughlin). Demonstrating method of continuous irrigation of chemical burns to the cornea.

diazene is equally efficacious) and a lid-immobilizing patch is applied.

During the first consultation, special attention should be given to all possible foci of infection, especially the teeth. While treatment of the foci need not be started at this time, it is important that they be noted on the record. Treatment is started if the eye does not heal by first intention. It has been the author's observation that more vision has been lost in chemical burns due to focal infection than by the actual effect of the offending agent.

AFTERCARE OF THE DENUDED EYE

This subject is of utmost importance

and careful attention to detail will be rewarded with satisfactory results. Warning is given the patient at the first consultation that considerable pain is to be expected, due to the denuding, and each patient is provided with 0.5-percent ophthalmic pontocaine ointment, with instructions to apply it aseptically to the eye as frequently as is needed to control pain. Some persons, due to a difference in pain threshold, will require barbiturates, and a few may need morphine. The immobilizing patch is to be worn at all times except during actual treatment.

The eyes are inspected under fluorescein stain upon the day following denudation and, if found to be healing by first intention, no change is made in therapy. If, however, undue reaction is found, the eye is placed at temporary rest by the instillation of a few drops of 5-percent homatropine solution, and 5-percent sulfathiazole ointment is added at four-hour intervals. The choice of homatropine is made so that loss of time, an important factor in industrial practice, will be minimized if the eye heals promptly.

On the third day, inspection is again made, and, if healing is not complete, there is presumptive evidence that the burn has converted to an infected ulcer, and active combative treatment is instituted. The eye itself is sprinkled with methylene-blue powder, and the excess flushed away. Pontocaine, sulfathiazole, and the immobilizing patch are continued. An intramuscular injection of 5 c.c. of proteolac (G. D. Searle and Company) is given, and administration of maximum doses of sodium salicylate is started. Dental X-ray or medical examination of other foci is made, and such areas, if amenable to treatment, are removed at the earliest possible moment, regardless of the condition of the eye. In the event that surgical treatment of foci is to be undertaken, the patient is hospitalized and intravenous

typhoid-vaccine fever therapy is begun. The surgical procedures are so arranged that they fall on the rest day in the typhoid series. At this point, the eye is atropinized because prevention of time loss is no longer a factor to be considered, and the whole attention must be turned toward the healing of the eye.

After healing has taken place and the cornea has been free from fluorescein staining areas for 48 hours, any residual opacity is treated with increasing percentages of dionin or with choline chloride.

CASE REPORTS

Table 2 lists 500 consecutive cases of chemical eye burn treated by the author in the last three years. Details of the seven cases in which some loss of vision resulted follow this table.

Due to the fact that they were in the process of manufacture, the chemicals listed varied in concentration and purity. Many of them are recorded by the abbreviated names under which they are known in industry, and many are actually combinations of several substances which are used in the manufacture of a given product. While the author realizes that inaccuracies exist, it is, nevertheless, significant that the denuding technique is efficacious upon burns from a wide variety of chemicals.

CASES OF LOSS OF VISION

Case 1. Acetic-anhydride burn. This case was treated with the proper technique but the patient had several abscessed teeth and was very uncoöperative, refusing to remain in the hospital. The teeth were finally extracted on the second admission to the hospital but irreparable damage to the eye had taken place. Total loss of vision of the injured eye resulted. Notable in this case is the fact that another employee was injured as severely in the same accident. He was

TABLE 2

CHEMICALS WHICH PRODUCED 500 HUMAN CORNEAL BURNS, AND THE RESULTS OF TREATMENT BY THE DENUDING TECHNIQUE

Chemical	Prompt Healing 48 Hours	Slow Heal- ing 3-10 Days	Loss of Vi- sion	Chemical	Prompt Healing 48 Hours	Slow Heal- ing 3-10 Days	Loss of Vi- sion
"Absorbine Jr."	—	1	—	Isophorone	1	—	—
Acetaldehyde	30	3	—	Isopropyl acetate	—	2	—
Acetic anhydride	16	3	1	Isopropanol	2	—	—
Acetoacetalide	2	1	—	Lime	51	3	3
Acetone	3	—	—	Lye (household)	1	—	1
Acetyl chloride	1	—	—	"Magic Washer" (house- hold bleach)	1	—	—
Acetylene tetrachloride	1	—	—	Maleic anhydride	14	—	—
Acrolein	1	—	—	Methanol + ethylene di- chloride	2	—	—
Alkylized tin	—	1	—	Methyl chloride	1	—	—
Allyl alcohol	5	1	—	Monoethanolamine	3	—	—
Alum	2	—	—	Naphtha	1	—	—
Aluminum chloride	4	1	—	"Nickel catalyst"	8	1	—
Aluminum nitrate	1	—	—	"Oakite"	1	—	—
Aluminum sulphate	1	—	—	Ocyl alcohol	2	—	—
Ammonia, aqueous	3	—	—	Oxalic acid	2	—	—
Ammonia, anhydrous	1	—	—	Phenylmethyl carbinol	2	—	—
Benzene	3	—	—	Phenylmethyl carbinol + Phenylmethyl ketone	1	1	—
Benzoic acid + phenyl- methyl ketone	1	—	—	Phosphorous oxychloride	1	1	—
Butadiene	2	—	—	Phthalic anhydride	8	—	—
Butyl acetate	1	—	—	Potassium dichromate	1	—	—
Butyraldehyde	6	—	—	Potassium hydroxide, 50%	1	—	—
Butanol	1	—	—	Potassium persulphate	1	—	—
Calcium carbide	3	—	—	Propylene oxide	3	—	—
Calcium carbonate	1	—	—	"Silver catalyst"	1	—	—
"Carbic" anhydride	3	—	—	Silver nitrate 50%	—	1	—
Catechol	4	2	—	Soap powder	1	—	—
"Catalyst gel"	1	—	—	Soda ash	1	—	—
"Cellosolve," methyl	1	—	—	Sodium hydroxide (solid)	12	2	—
Dichlorethyl ether	1	—	—	Sodium hydroxide, over 50%	—	2	—
"Clorox" bleach	1	—	—	Sodium hydroxide, 26 to 50%	27	1	1
Cresylic acid	1	—	—	Sodium hydroxide, 10 to 25%	89	3	—
Crotonaldehyde	8	—	—	Styrene	29	1	—
Dibutyl methiolate	1	—	—	Sodium sulphide	5	2	—
Diethylethanolamine	1	—	—	Sorbic acid	1	—	—
Diketene	2	—	—	Tantalum fluoride	1	—	—
Dimethyl phthalate	1	—	—	Toluene	2	—	—
Diphenyl oxide	4	—	—	Trichloroethane	1	—	—
"Drano"	—	—	1	Vinyl acetate	1	—	—
"Dripolene"	1	—	—	Vinyl chloride	1	—	—
Ethanol	1	—	—	Vinyl ethyl ether	1	—	—
Ethyl benzene	3	—	—	Viscose	—	1	—
Ethylhexanoic acid	1	—	—	Unknowns, various	13	3	—
Ethylene chlorhydrin	4	—	—				
Ethylene dichloride	20	—	—				
Ethylene oxide	1	—	—				
Ethanol toluene azetrope	1	—	—				
Hexanol	4	—	—				
Hexachlorethane	1	—	—				
Hexaethyl benzene	1	—	—				
Hydrofluoric acid	2	—	—				
Hydrogen sulfide	6	—	—				
				Totals	458	37	7

given identical treatment, and healing was by first intention.

Case 2. Fifty-percent sodium-hydroxide burn. This case was not seen by

the author for 48 hours after the burn. On first examination, it was determined that Bowman's membrane was involved, and a poor prognosis was given at that

time. The final vision in this case was 20/50.

Case 3. Lime burn. The patient in this case was treated by a general practitioner for three days previous to the time he was seen by the author. At that time, damage had already resulted. The patient was in poor health, having several infected teeth. After a protracted convalescence, the final vision in the injured eye was 20/60.

Case 4. Lime burn. This case was first seen by the author four days after the injury and no treatment of any kind had been given the patient. General health was poor, and loss of vision in the injured eye was total.

Case 5. Lime burn. The patient was given no first aid but was seen by the author within three hours after the injury. Healing was by first intention, but the newly formed epithelium broke down on the seventh day. Several abscessed teeth were removed on the same day, but a residual scar resulted. Final vision in the injured eye was 20/25.

Case 6. Fifty-percent sodium-hydroxide burn. The patient was not given the usual first-aid therapy and was not seen by the author until 24 hours after the injury. His general health was good. Final vision in the injured eye was 20/25.

Case 7. Twenty-five percent sodium-hydroxide burn. This case was treated according to the routine, but the patient

had many broken and abscessed teeth and was in poor health. The final vision in the injured eye was 20/30.

SUMMARY

From the study of 500 consecutive cases, the following conclusions are drawn:

1. Immediate first aid, followed by long flushing with water is of the utmost importance. No attempt at neutralization is recommended.

2. Specialized treatment by an ophthalmologist should be given within two hours after the injury. Further delay threatens recovery of full vision.

3. Denudation is the treatment of choice.

4. It is noted that the majority of cases, 456, or 91.2 percent, healed in 48 hours with no loss of vision; 37, or 7.4 percent, healed slowly, but without loss of vision; 7 cases, or 1.4 percent, healed with a residual loss of vision. The loss of vision in all seven cases was the result of inadequate preliminary care or health conditions present before the eyes were burned.

5. There is no mention made of conjunctival adhesions in this discussion, and it is notable that with the technique described the author had no such complication in any of these 500 consecutive cases.

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CHEMICAL BURNS OF THE RABBIT CORNEA*

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One of the most frequent and disturbing injuries that may occur in the manufacture of chemicals is accidental introduction into the eye. If time lost as a result of the accident is to be minimized, and impairment or loss of vision prevented, coördinated effort on the part of the plant medical service, the ophthalmologist, and the laboratory investigating plant hazards is essential. The clinical phases of this effort are discussed by McLaughlin¹ upon adjoining pages of this Journal. Where the behavior of the offending agent introduced into the eye has been determined by experiment upon animals, a better estimate of the potential seriousness of the injury may be made, and a more rational therapy instituted.

ESTIMATION OF EYE HAZARD BY THE RANGE-FINDING TEST

We have described elsewhere a quantitative method of assay to delineate the ability of a material to cause chemical burns of the rabbit eye as part of our range-finding test.² Because of the frequency of accidental entry of fluids into the eye, it was thought worthwhile to grade the severity of eye burns resulting from a large number of chemicals and mixtures. The work was started in 1938, and more than 4,000 rabbit eyes have been used to obtain this information.

We standardized the test for our own use six years before the communication of Friedenwald, Hughes, and Hermann³ was published, but it has been possible to employ a scheme not unlike theirs to translate each injury into a numerical score. The system is shown in table 1.

* From the Mellon Institute.

The validity of this procedure is established by the fact that, in those eyes in which we have followed healing, the time required for repair and the area of any terminal corneal scar were roughly proportional to the numerical score assigned to the initial injury. Moreover, the scores for injuries caused by decreasing volumes or decreasing concentrations of a chemi-

TABLE 1
SYSTEM FOR NUMERICAL SCORING OF INJURY TO
THE RABBIT EYE 24 HOURS AFTER
APPLICATION OF A MATERIAL

	Points	Maximum
<i>Symptom Visible Before Fluorescein Staining</i>		
Cornea dull	2	
Cornea opaque, less than half of area	4	
Cornea opaque, more than half of area	6	6
Keratoconus		6
Iritis, slight internal congestion	1	
Iritis, marked internal congestion	2	2
<i>Symptom Visible After Fluorescein Staining</i>		
(If necrosis is diffuse assign points corresponding to half observed area)		
Necrosis on less than 5% of cornea	1	
Necrosis on 5 to 12%	2	
Necrosis on 13 to 37%	3	
Necrosis on 38 to 62%	4	
Necrosis on 63 to 87%	5	
Necrosis on 88 to 100%	6	6
Total		20

cal form a smoothly descending numerical series.

The individual numerical scores of each eye treated with a given volume or concentration of a chemical are added together and then divided by the number of eyes (usually 5) to obtain the score of the injury caused by the treatment. We

have selected a level of 5.0 as representative of severe injury. This figure corresponds to necrosis, visible only after staining and covering about three fourths of the surface of the cornea; or a more severe necrosis covering a smaller area.

When a test is to be performed, normal albino rabbit eyes are selected on the basis of absence of grossly visible staining by a 5-percent aqueous solution of fluorescein sodium, flushed with distilled water 20 seconds after application. After a two-hour interval to allow the eye to return to normal, 0.005 ml. of the undiluted material is applied to the center of the cornea while the lids are retracted. About one minute later, the lids are released. This procedure is necessary to prevent the removal of a portion of the dose by the very efficient wiping system of the lids before intimate contact has been made with the eye. Eighteen to 24 hours later, the eye is examined in strong diffuse daylight, then stained with fluorescein, and the injury scored. Guided by the result and the table of injury grades below, additional applications are made until the chemical can be assigned to one of the grades we recognize. If large volumes are applied, the lids are held closed for one minute before the animal is released.

Where dilution of a chemical is necessary, our preferred solvent is propylene glycol from a batch shown to cause no injury. Preference is next given to water, and in some cases a deodorized kerosene known as "Deobase" has been used.

Our grading system is set forth in table 2. No ambiguities have yet been found, although they might be expected in a system that depends partly on volume and partly on concentration. The combination is necessary to separate the damage produced by chemicals of obviously

TABLE 2
GRADES OF INJURY EMPLOYED FOR RATING THE
RELATIVE DAMAGE PRODUCED BY
CHEMICALS IN THE EYE

Injury Grade	Definition
1.	0.5 ml. undiluted gives injury of 0 to 1.0 points
2.	0.5 ml. undiluted gives injury of over 1.0 up to 5.0 points
3.	0.1 ml. undiluted gives injury of up to 5.0 points (0.5 ml. gives over 5.0)
4.	0.02 ml. undiluted gives injury of up to 5.0 points (0.1 ml. gives over 5.0)
5.	0.005 ml. undiluted gives injury of up to 5.0 points (0.02 ml. gives over 5.0)
6.	Excess of 40% solution gives injury of up to 5.0 points (0.005 ml. gives over 5.0)
7.	Excess of 15% solution gives injury of up to 5.0 points (40% gives over 5.0)
8.	Excess of 5% solution gives injury of up to 5.0 points (15% gives over 5.0)
9.	Excess of 1% solution gives injury of up to 5.0 points (5% gives over 5.0)
10.	Excess of 1% solution gives injury of over 5.0 points

diverse abilities to injure that cannot be distinguished on the basis of the reaction to 0.005 ml. undiluted.

A total of 180 chemicals arranged according to the injury grades in which they fall appears in table 3. It must be recognized that in many cases somewhat impure industrial products have been tested, and impurities may possibly place some compounds in a grade other than that which would be occupied by a pure preparation. An asterisk (*) marks chemicals known to have caused loss of vision or very slowly healing corneal burns in industrial use, exclusive of injury produced only by vapors, which is a quite separate problem. It will be seen that the asterisks are associated with the higher grades. It must be recognized that a viscous chemical is less likely to reach the eye than is a more mobile compound and, accordingly, the grades here defined do not reveal the true hazard of handling the compounds, but rather their relative potential ability to cause damage once they reach the eye.

As related by McLaughlin,¹ the lists have been used with profit by one industrial medical service for prediction of the probability of permanent injury in a particular accident and for indication

in the plant dispensary of the therapeutic measures that are to be followed. Although these lists have been found useful and fairly reliable in practice, there have been a few instances in which they have

TABLE 3

INJURY GRADES OF SOME CHEMICALS WHEN APPLIED TO THE RABBIT EYE

Grade 1 (0.5 ml. undiluted yields score of 0 to 1.0)

Butyl phthalyl butyl glycolate	Ethylene glycol diacetate
1-3 Butylene glycol	Glycerine
"Carbowax" compound 1,500	Hexaethylene glycol
"Carbowax" compound 4,000	Methyl acetyl ricinoleate
Castor oil	Methyl "Carbitol" formal
Deobase (deodorized kerosene)	Methyl "Cellosolve" acetyl ricinoleate
Diallyl phthalate	Methyl phthalyl ethyl glycolate
Dibutyl "Cellosolve" phthalate	Methyl styryl phenyl ketone
Di-2-chlorethyl formal	Nonaethylene glycol
Dicyanoethyl sulfide	Polyethylene glycols 200, 300, 400, 600
Di-2-ethylhexyl phthalate	Polypropylene glycol
Diethylene glycol	Propylene glycol
Di-isobutyl ketone	Tetradecanol
Dimethoxy tetraglycol	Tetraethylene glycol
Dimethyl tetrahydrophthalate	Tri-2-ethylhexyl phosphate
Dipropylene glycol	Triethylene glycol
Ethoxy triglycol	Tri-isopropyl phenyl phosphate
2-Ethylhexyl acetate	
Ethylene glycol	

Grade 2 (0.5 ml. undiluted yields score of over 1.0 and not over 5.0)

Allyl chloride	Isopropenyl acetate
Butyl "Carbitol" acetate	Methyl borate (96% ester)
"Carbitol"	Methyl "Carbitol"
"Carbitol" acetate	Methyl "Cellosolve" acetate
Chlorethyl benzene	Paraffin oil U.S.P.
Dibutyl "Cellosolve" succinate	Propylene glycol diacetate
Diethylene glycol diacetate	Pyruvic aldehyde
Dimethyl "Carbate"	Thiodiethylene glycol
Dimethyl phthalate	Tributyl phosphite
2-Ethylhexyl-2-ethylhexanoate	
Ethylene cyanohydrin	

Grade 3 (0.5 ml. undiluted yields score of over 5.0 and 0.1 ml. yields not over 5.0)

"Cellosolve"	Ethylene dichloride
"Cellosolve" acetate	Hydroxyethyl acetamide
Diallyl maleate	Methanol
Dicyanoethyl amine	Undecanol
Diethyl "Carbitol"	Tributyl phosphate
Dimethyl maleate	Oil of citronella
Ethanol	Methyl salicylate
Ethyl benzene	Methyl benzyl "Cellosolve"
Ethyl propyl acrolein	Methyl "Cellosolve"

Grade 4 (0.1 ml. yields score of over 5.0 and 0.02 ml. yields not over 5.0)

Acetonyl acetone	Formamide
Butyl "Cellosolve"	Isophorone
3-Chloropropane diol-1,2	Isopropanol
Dichlorethyl ether	Methyl acrylate
Diethyl "Cellosolve"	Methyl "Carbitol" acetate
Dioxane	Methyl ether of propylene glycol
Epichlorhydrin	Propylene oxide tetramer
Ethyl acetoacetate	*Styrene
Ethyl ether of propylene glycol	Tetrahydrodimethyl furane
Ethylene glycol monacetate	Triethylene glycol dichloride
Ethylene sulfide	Trimethyl cyclohexanone

Grade 5 (0.02 ml. yields score of over 5.0 and 0.005 ml. yields not over 5.0)

Acetol	2-Ethyl hexoic acid
Acetone	Ethyl mandelate
*Allyl alcohol	Ethylene glycol diformate
Butyl "Carbitol"	Glyoxal (32.8% technical)
Cyclohexanone	Hydroxyethylene diamine
Diacetone alcohol	Isobutanol
2,3-dichloropropanol-1	Isopropyl mandelate
Diethanolamine	Isopropyl oil
Diethyl sulfate	Mesityl oxide
Diethylene triamine	Methyl diacetoacetate
Diglycol chlorhydrin	Methyl-3-hydroxybutyrate
Dimethyl dioxane	n-Morpholine ethanol
Dimethyl furane	Methyl dioxolane
Diethyl tetrahydrophthalate	Pentane dione
Ethyl borate	Phenyl ethanolamine
Ethyl crotonate	Propylene oxide
Ethyl hexane diol	Soap, USP tincture green
2-Ethyl hexanoic anhydride	Triethanolamine
2-Ethyl hexanol	Tetraethanol ammonium hydroxide (40%)

Grade 6 (0.005 ml. yields score of over 5.0, excess of 40% solution not over 5.0)

Dibutoxy tetraglycol
2-Ethylhexyl acrylate
Tri-isopropanolamine

Grade 7 (0.005 ml. and 40% solution yield scores of over 5.0, 15% solution not over 5.0)

n-Butanol	Mercaptoethanol
Benzyl "Cellosolve"	Methyl acetoacetate
Cyclohexanol	Morpholine
*Ethylene chlorhydrin	Phenyl methyl carbinol
*Ethylene imine	Propylene chlorhydrin
Glycolic acid	Toluene
Isopropanolamines, mixed	

Grade 8 (0.005 ml. and 15% solution yield scores of over 5.0, 5% solution not over 5.0)

Caproic acid	Phenyl methyl ketone
*Di-2-ethylhexyl amine	Soap (granulated white)
Di-n-Hexyl amine	Succinic acid
*Dimethyl sulfate	Succinic anhydride
*Ethylene diamine	Tetramethyl ethylene diamine
*Formaldehyde	Trimethyl adipic acid
Lactic acid	

Grade 9 (0.005 ml. and 5% solution yield scores of over 5.0, 1% solution not over 5.0)

*Acetic anhydride	Piperazine
*Ammonium hydroxide	*Propylene imine
*Ethyl chloracetate	*Sulfuric acid
2-Heptadecyl imidazoline	Tributyl phosphine oxide
Menthol	Trimethyl cyclohexanol
*Methyl silicate	3,5-Xylenol
Monoethanolamine	

Grade 10 (1% solution yields score of over 5.0)

*Maleic anhydride
*Sodium hydroxide

* Compounds known to have caused severe human eye injury.

resulted in misleading prognoses regarding particular eye burns. These difficulties can be attributed largely to the fact that workmen are unable to inform the plant dispensary fully about the composition of fluids which they handle. There is also

uncertainty of the relative sensitivity of human and rabbit eyes.

In general, only materials are included whose chemical names can be given. It is of some interest to relate that three commercial shampoos have been found

to fall in grades 4 and 5, and that those synthetic detergents which were tested fall in grades 5 to 8.

NEUTRALIZATION OF ALKALI AND ACID BURNS

Although it might be expected that acid or alkali burns of the eye could be treated effectively by immediate neutralization, such has not proved to be the case with experimental burns of rabbit eyes. Both eyes of a rabbit were burned with acetic anhydride and flushed with water. One eye was then treated with milk of magnesia while the other served as a control. Repeated trials revealed no reduction in healing time nor any appreciable decrease in the severity of the burns. Actually, in some cases the injury was aggravated. This finding led to an investigation of the reaction produced by milk of magnesia on the normal rabbit eye. Four popular brands of the preparation were procured and 0.5-ml. amounts were instilled morning and afternoon daily. The eyes were stained each day with 5-percent fluorescein sodium, which by test had been found to cause no damage in itself upon repeated application. On the third or fourth day of treatment, necrosis involving 40 percent or more of the cornea resulted from instillation of two of four samples. This effect persisted while the daily administration of milk of magnesia continued. It required three to four days for the eyes to attain a normal condition after cessation of the doses. This irritative action was produced mechanically, it is believed, by brucite, a crystalline form of magnesium hydroxide, which appears in the amorphous product after storage.

The use of 2-percent citric acid as a flushing agent in the treatment of alkali burns of the eye has been proposed by Ridley.⁴ To investigate the efficacy of

this treatment, corneal burns were produced on both eyes of an anesthetized rabbit with 0.2 ml. of 0.5-percent sodium hydroxide, and the eyes were irrigated with 2-percent citric acid and 0.85-percent saline, respectively, for a 30-minute interval. At the end of this period, the anterior portion of the conjunctiva of the eye washed with citric acid had a coagulated appearance with extreme congestion and edema elsewhere. With slit-lamp observation, the lens was barely visible through the corneal opacity. The saline-treated eye had a congested conjunctiva, and the corneal opacity was about one half as dense as that of the other eye. Both eyes revealed complete surface necrosis upon staining with fluorescein the following day. The eye washed with citric acid showed opacity of the endothelium and Descemet's membrane with a cloudy stroma, whereas those structures were less injured than was the epithelium in the saline-treated eye. On the fifth day, the eye washed with citric acid had a thickened cornea, feathery opacity of the epithelium and stroma, and opacity of the endothelium. Macroscopically the opacity was very pronounced, and fluorescein stained the surface completely. At this time, the saline-washed eye was normal, with no opacity nor surface necrosis. After 17 days, the citric-acid-treated cornea contained a 3- by 3-mm. area filled with fluid in which were seen many punctate bodies, in all probability a leucocytic infiltration. There was considerable vascularization of the paralimbal region, and diffuse fluorescein staining of the cornea. After one month, this eye bore no resemblance to a functional organ because of necrosis, fibrosis, and conjunctival evagination.

To evaluate the effect of irrigation with 2-percent and 0.5-percent citric acid alone, normal unburned eyes of rabbits

under anesthesia were used. After 30 minutes, the left eye which received 2-percent citric acid had a cloudy cornea and edematous lids. The right eye, washed with 0.5-percent acid, had the same type of injury to a lesser degree. The opacity was localized in the internal layers of the cornea, either deep in the stroma or in Descemet's membrane and the endothelium. Twenty-four hours after the irrigation the left eye showed solid opacity and 100-percent necrosis with fluorescein. The right eye was cloudy and 80 percent of the cornea stained. After two weeks, the left eye was opaque, with a thickened cornea. The surface had 10-percent dense necrosis surrounded by opacity over the pupillary area, with some vascularization from the dorsal limbus. The stroma of the right eye was clearing nicely, but opacity of deeper layers was still visible under slitlamp observation. After the lapse of almost a month, there was a 5-mm. staphyloma over the pupillary area, which ruptured while the rabbit eye was being examined. The right eye showed cloudiness throughout the cornea under the slitlamp, an opacity that was also visible without aid.

Obviously, even though a single instillation of 0.5 ml. of 2-percent citric acid produced corneal necrosis in only one of five rabbit eyes, and applications repeated for seven days produced only sporadic nonpersisting small areas of necrosis, the 2-percent solution is absolutely and unequivocally to be avoided for prolonged irrigation. The same is true for 0.5-percent citric acid as an irrigating agent.

QUALITATIVE STUDIES ON ALKALI BURNS

The remarkable healing of alkali burns of the human eye which had been treated by simple denudation-led McLaughlin¹ to inquire into the mechanism of action underlying the necessity for complete re-

moval of the affected tissue as a means of preventing penetration and subsequent damage to the eye. A request for collaboration in the investigation of these problems was made to us.

The first matter for consideration was the suitability of the eye of the albino rabbit for test purposes. Walls⁵ states that a Bowman's membrane is seldom discriminable in the placentalian eye and in lower animals cannot ordinarily be discerned as a distinct part of the substantia propria. Our inability to measure the thickness of Bowman's membrane in the living animal by means of the slitlamp led us to the examination of stained histologic preparations, as differences in structural dimensions between the human and rabbit cornea might well have an important bearing on their respective responses to treatment after chemical burns.

Stained histologic sections of normal human and rabbit corneas were measured microscopically. The human corneal epithelium and Bowman's membrane measure 45.4 and 8.4 microns, respectively, compared to 33.6 and 1.75 microns for the corresponding structures in the rabbit eye. Although these figures do not represent *in vivo* dimensions, they illustrate the relative differences. The greater thickness of the epithelium of the human cornea presents a better mechanical barrier to chemicals penetrating to Bowman's membrane. Furthermore, this thicker epithelium of the human eye will permit deeper denudation for the removal of the offending agent without damage to the underlying Bowman's membrane, the integrity of which must be preserved if scar formation is to be prevented. This quantitative difference in structure may offer a decided advantage to the ophthalmologist in treating human-eye burns by the denudation technique. (The foregoing refers to a structure discriminable in

stained preparations, which we interpret as Bowman's membrane.)

Eye injuries produced by chemicals may be divided into three categories; namely, those produced by neutral, acid, and alkaline materials. Acid causes an immediate reaction which does not appear to increase in depth with time. Neutral chemicals usually act similarly, but some cause delayed burns. For example, the history in a few human cases which we observed could be explained only on the basis of a delay of several hours between contact with a fluid ester (methyl silicate) and development of injury. The mechanism causing a delay is not yet clarified. Acid and neutral burns were not investigated in the present study. Following alkali burns, McLaughlin¹ found, clinically, that immediate denudation of the involved area becomes necessary to prompt healing, presumably because it prevents penetration of alkali into Bowman's membrane. This fact raises the question as to what may happen after alkali reaches the eye. The damage may be caused by the lytic action of the alkali *per se*, by a product formed as a result of its chemical union with protein, or possibly by the elaboration of some agent from injured cells which stimulates the inflammatory process.⁶

The presence of alkali retained after flushing was demonstrated by the use of an ordinary pH indicator. Rabbits were anesthetized, and 0.05- to 1.0-ml. amounts of aqueous 4-percent sodium hydroxide were pipetted onto the cornea and allowed to remain for 30 seconds. Irrigation or continuous surface flushing of the eye with 0.85-percent sodium chloride was then instituted and continued for 30 minutes. Retention of hydroxyl ions was determined by excising a 2- or 3-mm. circle of corneal epithelium and testing its reaction. The tissue was at once mounted in a sealed hanging-drop prep-

aration in unbuffered 0.03-percent metacresol-purple indicator adjusted to the midpoint of its range, which covers pH 7.6 to 9.2. This indicator was selected because its range is above pH 7.2, the reaction of the normal surface of the rabbit cornea. Similar pieces of corneal tissue were always taken from the unburned eye of the same rabbit to serve as controls. Numerous trials with such preparations demonstrated that normal corneal epithelium was acid to the indicator, as it produced a yellow color, whereas tissue from the alkali-burned eye was strongly basic as evidenced by the development of a purple color. Furthermore, when a series of rabbits were treated and killed singly at various intervals of time, traces of alkali could be demonstrated, colorimetrically, 24 hours following the application and flushing.

The pH of the normal and alkali-burned corneas was also determined electrometrically with a glass electrode shaped to fit the curvature of the eyeball. Eyes were burned with 0.2 ml. of 1.0-percent sodium hydroxide and also with the same amount of a 5-percent aqueous solution of a less highly ionized alkali, ethylene diamine. All burned eyes were irrigated with physiologic saline for 30 minutes before the surface pH was determined. The left eye of each rabbit was burned, and the right eye served as a control.

The figures given in table 4 are in-

TABLE 4
ELECTROMETRIC pH DETERMINATIONS OF BURNED
AND NORMAL RABBIT EYES, AFTER
30-MINUTES' FLUSHING

	NaOH	Ethylene Diamine
Surface pH of burned left eye	8.0	8.1
Surface pH of normal right eye	7.2	7.2
Aqueous humor of burned left eye	8.5	8.7
Aqueous humor of normal right eye	8.2	8.2

teresting in that the normal pH of aqueous humor of the human eye according to Best and Taylor⁷ is 7.1 to 7.3, whereas the determinations on normal rabbit aqueous humor indicate a pH of 8.2, or 10 times the hydroxyl-ion concentration of the human aqueous. The demonstration of increased alkalinity of the aqueous humor following sodium-hydroxide and ethylene-diamine burns illustrates the ability of alkaline materials to penetrate the rabbit cornea. It would be expected, therefore, that where the buffering capacity of the aqueous humor is exceeded, damage to delicate internal structures of the eye will occur.

An *in vivo* test was devised to verify further the presence of alkali in tissue burned with sodium hydroxide. This technique is referred to as a "transfer burn" for reasons which the procedure will make plain.

After intravenous sodium-pentobarbitol anesthesia, one eye of the first rabbit, the transfer donor, is burned with 0.2 ml. of 1-percent sodium hydroxide and irrigated for 30 minutes with 0.85-percent sodium chloride, after which the animal is killed by intravenous air embolism. The superficial layers of the cornea—that is, epithelium and adherent substantia propria—are peeled from the entire anterior surface of the eye in one piece. This tissue is repeatedly punctured with the point of a scalpel and trimmed in the form of a cross. The perforation increases the opportunity for retained alkali to escape and the crosslike pattern provides tissue which will make good contact upon application to the normal eye of a second rabbit, the transfer recipient. Great care was exercised at all points to eliminate the possibility of alkali being carried by the instruments used.

The recipient is anesthetized and immobilized so that its head cannot be moved. The cross-shaped tissue from the

donor is placed with its center over the pupillary area of the recipient so that the burned epithelium is in contact with the normal recipient epithelium. This piece of tissue is kept in place for a one-hour period, during which time the lids of the recipient are held apart in order that the tissue will not be disturbed nor tears flush the pupil. The transfer tissue is prevented from dehydration by the addition of 0.01-ml. amounts of distilled water as required.

After a one-hour contact period, the recipient is killed by air embolism, and the transfer tissue from the donor is removed and tested with meta-cresol-purple indicator to ascertain whether it still contains alkali. A 5- by 5-mm. piece of recipient corneal tissue which has been in intimate contact with donor tissue is then peeled off and likewise tested with the indicator in a sealed hanging-drop preparation. Repeated trials with this method resulted in the colorimetric demonstration of alkali in or upon the recipient corneal epithelium when tissue was taken from over the pupillary area where contact with the donor tissue had been most intimate. The colorimetric demonstration of alkali may fail if small pieces of corneal tissue about 1 by 2 mm. in size are removed and tested individually. This failure may be due to the fact that the alkali present in such a small piece of tissue is insufficient to cause a color change in the relatively large drop of indicator solution used, or that all portions of the recipient cornea are not uniformly burned with alkali. Roughly indential pieces of corneal tissue removed from the untouched control eye of the recipient always produced a yellow color with the indicator, which denotes pH 7.6 or less, whereas the treated recipient cornea produced a purple color, indicating pH 8.2 or above. The indicator must be accurately adjusted to the midpoint of its

range or the minute amounts of alkali present in the recipient cornea may not be sufficient to effect the color change.

To serve as a control on manipulative procedures, the test was carried out with the use of normal donor tissue instead of that burned by sodium hydroxide, but with entirely negative results. All tissue tested remained acid to the indicator. Earlier attempts at fluorescein staining of recipient cornea were abandoned as a means of detecting the presence of injury caused by the transfer of alkali when it was discovered that all rabbit eyes show a punctate staining of the cornea after 20 seconds' contact with 5-percent fluorescein under slitlamp observation, although macroscopically they were not visibly stained. This type of staining could not be demonstrated in normal human eyes when the same fluorescein stain was used. The recognition of this fact forced reliance upon indicator solutions for the demonstration, for the burns produced by the transfer method were so minute that direct slitlamp observations without fluorescein staining were not considered reliable. A further objection to the use of fluorescein at this point is that it would not distinguish between mechanical injury and chemical injury from alkali. On one occasion, a small opacity which persisted for 24 hours was noted, but the use of the indicator remained the method of choice. The presence of alkali was also demonstrated after the recipient's cornea was washed for about 5 seconds with distilled water before removal for testing with the indicator.

In view of the demonstration of increased hydroxyl-ion content of the aqueous humor following severe burns with sodium hydroxide, it was thought advisable to attempt a transfer burn by using aqueous humor taken from a burned eye. The procedure was essentially the same

as has been described except that aqueous humor was aspirated by means of a syringe and 26-gauge needle from both the burned and normal donor eyes and was applied dropwise every 5 minutes for 1 hour to one eye on each of two recipients. This procedure resulted in the action of aqueous humor from the donor's burned eye being compared with that from the donor's normal eye which served as a control. Slitlamp observation of both recipients' eyes showed no visible damage. The eyes were then flooded with distilled water for 5 or 10 seconds to remove any of the aqueous humor adhering to the surface. Colorimetric tests revealed that portions of the cornea removed from these eyes after the animals were killed did not differ from their normal untreated eyes. This demonstration indicates the probable buffer action of the aqueous humor which had been shown by electrometric determinations to have an increased hydroxyl-ion content.

DENUATION

The outstanding success accomplished by simple denudation of burned corneal tissue in the treatment of human eye burns is reported by McLaughlin.¹ The application of this technique to the treatment of controlled experimental burns of the rabbit cornea did not produce comparable results in our hands. It required three days for a normal rabbit eye to heal after it had been denuded by the cottonswab method following the instillation of 4-percent cocaine hydrochloride. This interval is about three times as long as it required for the regeneration of human corneal epithelium. Numerous controlled experiments that compared denudation and no treatment led to the conclusion that in dealing with the rabbit cornea any mechanical interference will retard rather than foster the natural healing process. Despite the quantitative differences in

structure previously mentioned, observation has shown that the rabbit eye has enormous regenerative power following very severe damage and that injury to Bowman's membrane does not always result in scar-tissue formation as is the accepted fact in the case of burns of the human eye although it now appears that its corneal epithelium regenerates slowly.

Although species difference prevented the confirmation of McLaughlin's findings when using the rabbit eye, his consistently successful results amply justify his recommended therapy.

CONCLUSIONS

Experiments have been made upon corneal burns in the rabbit intended to assist in the therapy of human corneal burns in industry. The results of this work point to certain conclusions.

1. It is possible to grade the ability of fluid and dissolved chemicals to injure the cornea on the basis of application of a series of volumes and concentrations to the rabbit eye. The results correlate well with clinical experience in a plant handling a wide variety of compounds.

2. Alkaline molecules reaching the cornea are bound in some fashion to the epithelial cells and are not removed by prolonged washing with saline or water. Alkali bound in this fashion will be liberated from excised epithelium to injure intact epithelium in contact with the former. Presumably alkali is slowly liberated from its original site of fixation in the living eye to injure neighboring cells and result in a progressive burn.

3. Attempts to neutralize alkali on the cornea by prolonged flushing with dilute citric-acid solutions result in seriously aggravating the condition of the eye. Similar attempts to neutralize acetic-anhydride burns with milk-of-magnesia applications are less spectacularly harmful but they are not beneficial.

4. Alkali contacting the cornea penetrates it to a sufficient extent to raise the pH of the aqueous humor and threaten internal ocular structures.

5. The treatment of alkali burns upon rabbit cornea by denudation failed to demonstrate its effectiveness owing apparently to species differences in the rate of epithelial regeneration.

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FURTHER OBSERVATIONS ON AQUEOUS VEINS*

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Although the site of exit of the intraocular fluid has been discussed for many decades, the actual elimination of the aqueous humor was biomicroscopically observed in May, 1941.¹ In, or beneath, the conjunctiva of normal human eyes, I chanced to see small, almost or completely colorless vessels emerging from the depth of the corneal limbus or from the limbal meshwork or from a scleral emissarium. When they joined episcleral or conjunctival veins, these clear vessels produced a more or less marked dilution of the blood streaming through these veins; often they continued to transmit a layer of clear fluid into the vein they had joined. I proposed to name these vessels, "aqueous veins," assuming that they were biomicroscopically visible pathways carrying intraocular fluid from Schlemm's canal and the deep scleral venous meshwork to the episcleral, conjunctival, and anterior ciliary veins.

Leaving the canal of Schlemm, the aqueous humor may rapidly and completely mix with the blood contained in the scleral venous meshwork (fig. 1), in which case, no clear fluid becomes visible in any of the conjunctival or subconjunctival veins. If and where, however, aqueous humor passes through the scleral meshwork without being mixed with blood, or accepting only a small amount of blood, clear fluid will become discernible (figs. 2, 3, 4). (See also table 1.)

While many ophthalmologists have had difficulty in recognizing the aqueous veins, others have confirmed their occurrence and significance. Some of these confirmations came a short time after the discovery of the biomicroscopically visible intraocular-fluid elimination was published, some later.

Vail became familiar with the aqueous veins soon after their detection and emphasized their importance.² Troncoso³ recognized the aqueous veins as an anatomic-physiologic fact. Verhoeff⁴ was the first to raise the farsighted question as to whether, with high intraocular pressure and a normal filtration angle, the clear stream in the aqueous veins would become longer. This question could not be answered immediately. Further observations on glaucomatous eyes⁵ showed that, in primary compensated glaucoma, the flow of aqueous is less vigorous and that it may become stronger after successful treatment with miotics or after successful surgery. Berliner⁶ referred to the aqueous veins without espousing their cause; this may be explained by the fact that, according to his references, only the preliminary note about the aqueous veins was used and that a more extensive discussion⁷ could not yet be considered for the manuscript of his textbook. Sugar⁸ and Gartner⁹ were able to see the aqueous veins, the latter even succeeded in photographing them. It is not easy to obtain satisfactory photographs of the aqueous veins proper, for they are only 0.01 to 0.1 mm. in diameter,^{1, 10} and, since they are mostly colorless trails, contrast but little with the surrounding sclera. The recipient vessels, characterized by their stratification, are more easily observable by means of both

* From the Department of Ophthalmology, College of Medicine, University of Cincinnati, Dr. H. Reid, Director. Presented at the 15th scientific meeting of the Association for Research in Ophthalmology, Inc., at San Francisco, July 2, 1946. This research has been aided by a grant from the Snyder Ophthalmic Foundation.

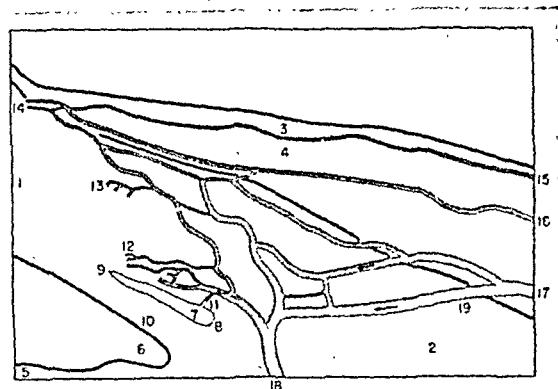


Fig. 1 (Ascher). AQUEOUS HUMOR LEAVING THE CANAL. Upon leaving the canal, the aqueous usually fades into the venous blood of the scleral meshwork. Therefore, no clear fluid is visible in the superficial veins of more than one half of all normal, quiet eyes.

Numerals on this diagram and those of illustrations 2 to 9 have the following significance: 1, Cornea. 2, Sclera. 3, Conjunctiva. 4, Subconjunctival space. 5, Iris. 6, Chamber angle. 7, Canal of Schlemm. 8, Scleral border of canal. 9, Corneal border of canal. 10, Trabecula. 11, Outlet of canal, falsely collector. 12, Venous part of deep meshwork. 13, Venous part of scleral meshwork. 14, Venous part of limbal meshwork. 15, Conjunctival vein. 16, Subconjunctival vein. 17, Anterior ciliary vein. 18, Anastomosis to ciliary body. 19, Emissarium sclerae. All arteries have been omitted for simplification.

biomicroscopy and photography.

Among those who have seen the aqueous veins but have not as yet published

their observations, I should mention Kronfeld,¹¹ Rohner,¹² and Weve.¹³

Although I was able to see the aqueous veins in about every fourth, and later in every third eye of all normal eyes that came under my observation, Gartner⁹ found them in 20 percent, and Goldmann¹⁰ in 75 percent of persons examined. Most of the aqueous veins that I have seen were located in either eye between the 2- and the 4-o'clock positions or between the 8- and the 10-o'clock positions in, or at a short distance from, the corneoscleral limbus. Goldmann¹⁰ found the aqueous veins mostly in the lower temporal or in the lower nasal quadrants. He, as well as Gartner,⁹ confirmed the stratification or layering of aqueous and sanguineous fluid running in the same vessel and forming two or three or more parallel strata. Both observed changes of this stratification following experimental manipulations. Changes in the blood-aqueous ratio which occur in aqueous veins after compression (figs. 5, 6) of their recipient vessel (see ref. 1, p. 36; ref. 5, pp. 1077-1084; ref. 7, pp. 1193-1198) were confirmed by Sugar,⁸ Gartner,⁹ Goldmann,¹⁰ and Kronfeld.¹¹ After compression of the recipient vessel, Goldmann more often observed an influx of

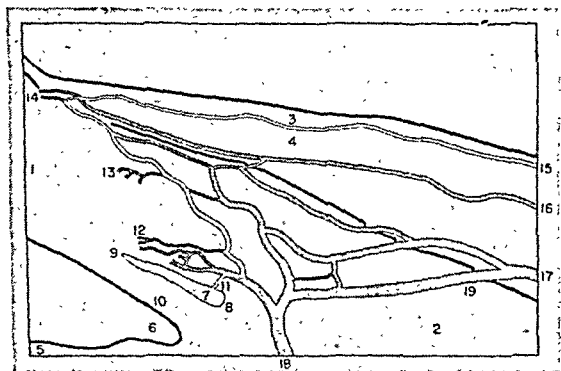


Fig. 2 (Ascher). Aqueous vein: ORIGIN IN LIMBAL LOOPS. *Diagram:* Having left the canal of Schlemm (7), clear fluid may pass the scleral meshwork (13) and, if not mixed with blood, may become visible in the limbal capillaries (14). *Drawing:* At the point E, the color of the vein abruptly changes to a very pale pink, proving the entrance of an aqueous vein from the depth of the limbus.

clear fluid (I had called this the positive glass-rod phenomenon), whereas Sugar⁸ and Gartner⁹ more frequently saw an influx of red blood cells into the aqueous

backflow of blood into the canal of Schlemm. Goldmann¹⁰ corroborated Sugar's conclusions, and mine, that the observations made on aqueous veins prove

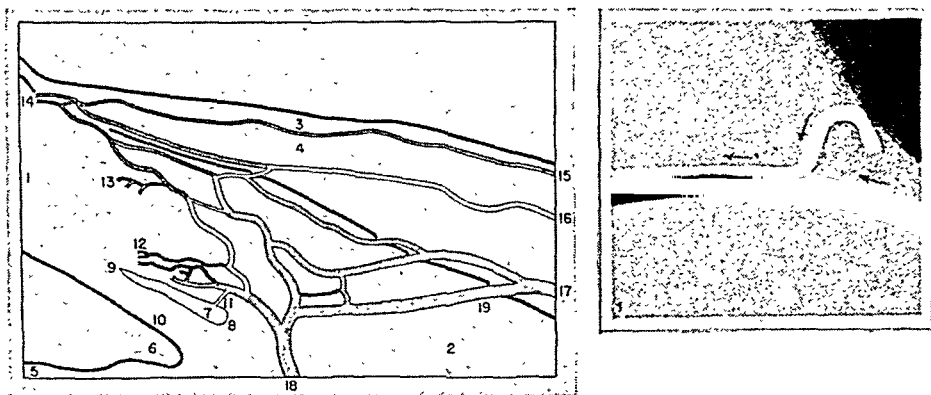


Fig. 3 (Ascher). Aqueous vein: ORIGIN IN SCLERAL TISSUE—the most common type of aqueous-vein origin. *Diagram*: Clear fluid, if not mixed with blood, may become visible in a spiral or U-shaped arch, one limb of which emerges out of the scleral tissue. *Drawing*: The peripheral limb of the U-shaped arch ascends into the conjunctiva to join a conjunctival vein and to form a stratified current.

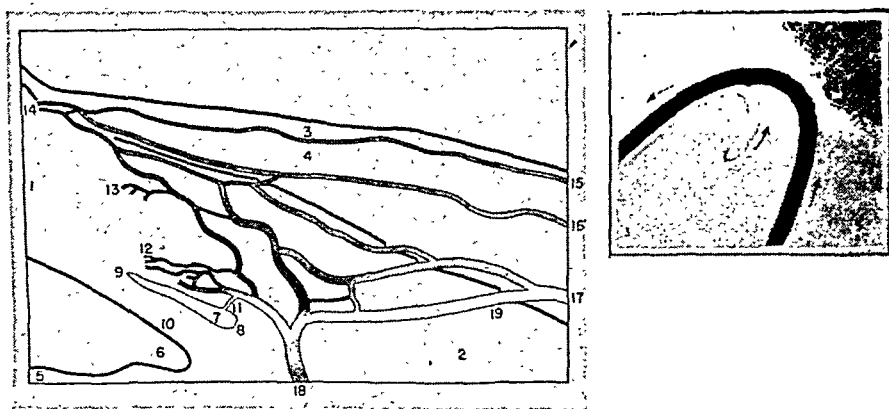


Fig. 4 (Ascher). Aqueous vein: ORIGIN FROM SCLERAL EMISSARIUM. *Diagram*: Having passed a part of the scleral meshwork, clear fluid may become visible in a scleral emissarium (19). *Drawing*: The largest aqueous veins are found among those originating from a scleral emissarium.

vein (the negative glass-rod phenomenon). Anatomic differences in individual eyes are, most probably, responsible for this apparent discrepancy (see ref. 5, p. 1084).

Sugar¹⁴ expressed the opinion that the presence of the aqueous veins gives evidence for a through-and-through circulation of the aqueous humor, and that their presence also explains why the application of the gonioscopic contact lens may cause

that there is a continuous elimination of aqueous humor taking place via the canal of Schlemm and the episcleral veins. Goldmann (ref. 10, p. 152) also agreed to my computation of the amount of aqueous humor eliminated by the aqueous veins. Considering the figures published about the diameters of the outlets of Schlemm's canal and those pertaining to the speed of movement in conjunctival vessels, I reached an approximate accord

between the amount of fluid possibly eliminated by aqueous veins and the estimations published in the literature (ref. 7, p. 1192).

Soon after the discovery of the aqueous veins, spontaneous as well as provoked pulsations were observed. These pulsa-

adrenalin solution into the conjunctival sac.

Some of the pharmacologic effects which I have described¹⁵ were confirmed by Gartner⁹ and by Goldmann.¹⁰ Gartner published photographs showing aqueous veins before and after administration of

TABLE 1
A PHYSIOLOGIC UNIT: THE CANAL OF SCHLEMM AND THE AQUEOUS VEINS

	Canal	Aqueous Veins
Embryology	Common primordial anlage (Sondermann, Ida Mann)*	Common primordial anlage
Anatomy	"Outer channels" connect Schlemm's canal with anterior ciliary veins (Schlemm, Leber, Maggiore, Troncoso, Henderson, Theobald, Friedenwald)	"Outer channels" connect Schlemm's canal with anterior ciliary veins
Physiology	Elimination of aqueous humor (Leber, Lauber, Troncoso, Seidel, Friedenwald)	Elimination of aqueous humor
Contents	Aqueous humor mixed with blood in varying proportions (Trantas, Salzmann, Troncoso, Friedenwald)	Aqueous humor mixed with blood in varying proportions
Distribution of contents	Stratification may occur (Troncoso)	Stratification very common
Changes in blood—aqueous ratio	Very common (Sugar, Bangerter & Goldmann, Kronfeld)	Very common
A. With increase of venous pressure	Backflow of blood into the canal (Bangerter & Goldmann)	Negative glass-rod phenomenon; i.e., blood enters the aqueous veins
B. With increase of aqueous pressure	Expulsion of blood from the canal (Kronfeld)	Positive glass-rod phenomenon; i.e., expulsion of blood from the aqueous veins
C. With decrease of aqueous pressure	Backflow of blood into the canal (Barkan, Kronfeld)	Negative glass-rod phenomenon; i.e., blood enters the aqueous veins

* For references quoted in this table see previous publications. (1,5,7)

tions were synchronous with the radial pulse and consisted of minute changes in the position of border lines separating the aqueous and the sanguineous phases, respectively (see ref. 1, p. 36; ref. 7, pp. 1201-1203). Goldmann¹⁰ confirmed the observation of these pulsating border lines and found that the peak of the clear-fluid influx was slightly delayed as compared to the radial pulse. He was able to increase these pulsations by instillation of

miotics. He confirmed my observation that miotics may markedly reduce the red-blood-cell content of an aqueous vein (see ref. 15, pp. 1302-1303; ref. 16, p. 1313). Goldmann¹⁰ reported the effects of adrenalin administration on aqueous veins corresponding to my observations (ref. 15, pp. 1304-1306).

While Verhoeff⁴ assumed a relationship between the increase of intraocular pressure and the visible outflow of aque-

ous humor, Gartner⁹ expressed the opinion that damage to an aqueous vein during an operation for glaucoma might have considerable influence on the intraocular pressure. Therefore, he determined to locate the aqueous veins of glaucoma patients in order to avoid injuring these important structures during surgery.

1075-1077 and 1079-1087; ref. 16, pp. 1309-1314) a working hypothesis was evolved, an hypotheses which, it is to be hoped, may be confirmed by future histologic investigations. I assumed that transient or permanent narrowing in the outlets of Schlemm's canal may be the cause for the failure of glaucomatous eyes

TABLE 2

A UNIT OF CLINICAL SIGNIFICANCE: THE CANAL OF SCHLEMM AND THE AQUEOUS VEINS

Condition	Gonioscopy of the Canal Shows	Biomicroscopy of the Aqueous Veins Show
Inflammation	Blood enters the canal (Trantas, Salzmann, Koeppe, Troncoso)*	Aqueous veins filled with blood; therefore, not discernible
Congestion	Blood enters the canal (Schlemm)	Aqueous veins filled with blood; therefore, not discernible
Primary compensated glaucoma	Blood rarely enters the canal (Bangerter and Goldmann, Kronfeld). Wessely effect inverted	Negative glass-rod phenomenon; i.e., blood enters the aqueous vein after compression of the recipient vessel
Decompensated glaucoma	Not yet studied	Aqueous veins carry blood from posterior uvea; therefore, not discernible
Secondary glaucoma	Wessely effect present (John)	Mostly negative glass-rod phenomenon
Controlled glaucoma	Blood enters the canal (Kronfeld and assoc.)	Sometimes positive glass-rod phenomenon; i.e., clear fluid expells blood from aqueous vein after compression of the recipient vessel

* For references quoted in this table see previous publications. (1,5,7,16)

Because of the wide areas treated when operating by cyclodiathermy, the damage which this procedure might cause to the aqueous veins is of particular concern to Gartner. He advised that the aqueous veins be undisturbed during any operation for the relief of glaucoma. Goldmann¹⁰ stressed the significance of the rapid outflow of aqueous humor, as observed biomicroscopically, for an understanding of the mechanism of such operations (table 2).

AQUEOUS VEINS IN THE ETIOLOGY AND CLASSIFICATION OF GLAUCOMA

From a cursory discussion of the role of the aqueous veins in the etiology and pathogenesis of glaucoma (see ref. 5, pp.

to show the backflow of blood into the canal, as observed gonioscopically by Bangerter and Goldmann.¹⁷ In some cases, changes in these outlets may even be the primary cause for the increase in intraocular pressure (figs. 7, 8).

In order to discuss the role of aqueous veins in the etiology of glaucoma, we may use Sugar's¹⁴ classification of glaucoma. Between the groups "failure of osmotic forces" and "mechanical closure of the chamber angle," it may be justifiable to insert: "occlusion of aqueous veins by different pathologic conditions in the limbal region." These conditions include keratitis, scleritis, tumor growth, and a possible idiopathic narrowing of the outlets of Schlemm's canal. Cases of appar-

ently primary glaucoma caused by this narrowing of the outlets should be classified as secondary glaucoma.⁵ (Table 3.)

In the group designated glaucoma secondary to cataract surgery, a blocking of aqueous veins by scar formation adjacent

merous outlets of Schlemm's canal seem to be available for intraocular-fluid elimination; even if all outlets situated along the incision should become obliterated by scar formation, those situated in the unsevered part of the limbus still could

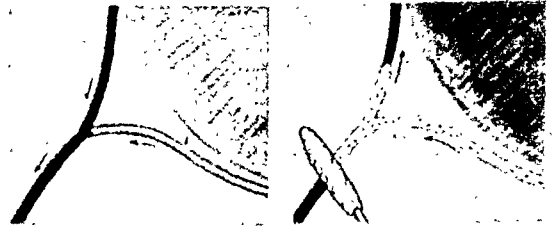
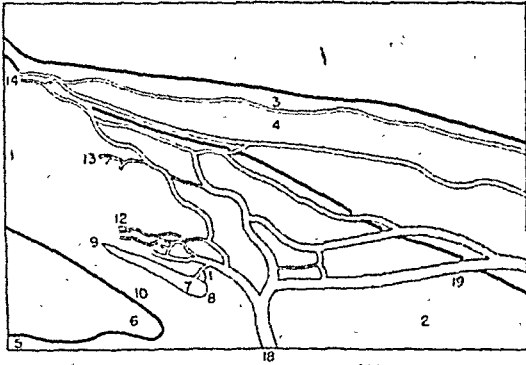


Fig. 5 (Ascher). POSITIVE GLASS-ROD PHENOMENON. *Diagram:* After compression of the recipient vessel, clear fluid enters the blocked section and, in a reversal of current direction, expels the blood corpuscles from the recipient vessel (note arrows in drawing). Expulsion of red cells is the essence of the positive glass-rod phenomenon. *Drawing:* A large, pale vessel runs along the nasal lower limbus and eventually joins a regular conjunctival vein. Immediately after compression, practically all red blood cells leave the pale vessel and the adjacent section of the recipient vein. Both become as clear as water. The red blood cells retreat in an upward direction (note arrows).

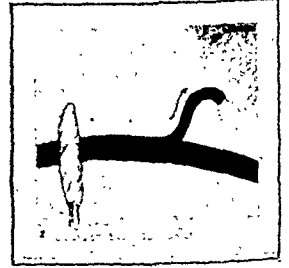
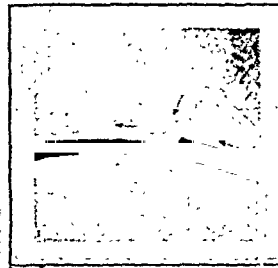
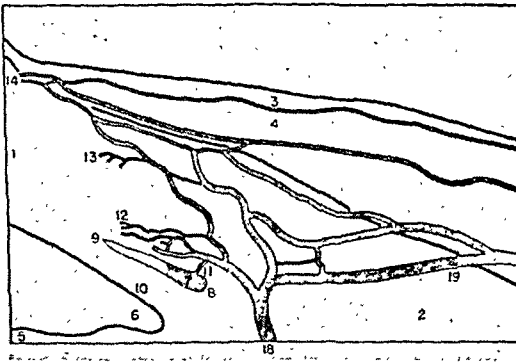


Fig. 6 (Ascher). NEGATIVE GLASS-ROD PHENOMENON. *Diagram:* After compression of the recipient vessel, red blood cells enter the aqueous vein in a direction opposite to that of the previous aqueous flow. Blood may enter the canal of Schlemm (7). *Drawing 1:* At the 7-o'clock position, near the limbus, an aqueous vein joins its recipient vessel to form stratified current. *Drawing 2:* After compression of the recipient vessel, the stratification disappeared and the red blood cells entered the aqueous vein in a direction opposite to that of the previous aqueous flow (note arrows). Entrance of red blood cells into the canal of Schlemm is probable.

to the cataract incision is to be considered a possible cause of secondary glaucoma. In such a case, the increase of intraocular pressure may not, or at least not solely, be due to mechanical closure of the chamber angle. Along the corneoscleral limbus, nu-

continue to eliminate aqueous humor. In border-line cases, however, where intraocular pressure is near the upper limit, severing of a part of the outlets during surgery may suffice to produce a postoperative increase of intraocular pressure.

Up to the present time investigators have not ascertained whether or not all of the 20 to 30 outlets of Schlemm's canal are equal in physiologic value. Anatomic differences, as demonstrated by Theobald, are rather definite,¹⁸ with diameters of the single outlets varying between 5 and 50 mikrons, that is, in a ratio of 1 to 10. It seems reasonable to assume that an outlet measuring 50 μ in diameter will be more important for the in-

Schlemm. It is possible that, in some eyes, a great number of outlets are constantly eliminating aqueous humor; whereas, in other eyes, only a few outlets or even only one outlet may carry the main bulk of it (ref. 7, p. 1192).

In eyes of the latter type, surgical or traumatic severing of one of these main channels may initiate a disastrous increase of intraocular pressure. Gartner⁹ seems to have been the first surgeon who paid at-

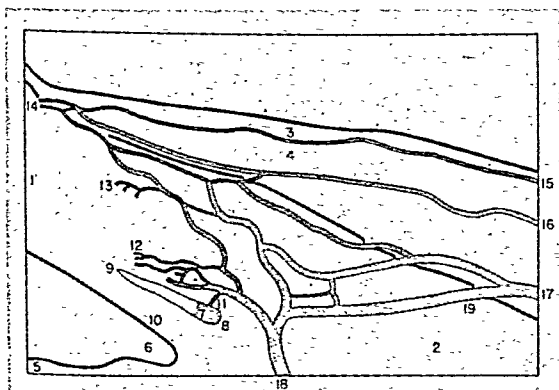


FIG. 7

Fig. 7 (Ascher). BLOOD MAY ENTER SCHLEMM'S CANAL in the presence of any of the following conditions: Inflammation (Salzmann, Trantas, Troncoso); rubeosis iridis (O. Kurz); strangulation (Schlemm); pressure of the gonioscopic lens (Sugar, Bangert and Goldmann); decrease of intraocular pressure (Kronfeld and associates). Although Schlemm's canal has been thought to contain either colorless fluid or blood, considerable evidence has accumulated that it may contain separated layers of each of them.

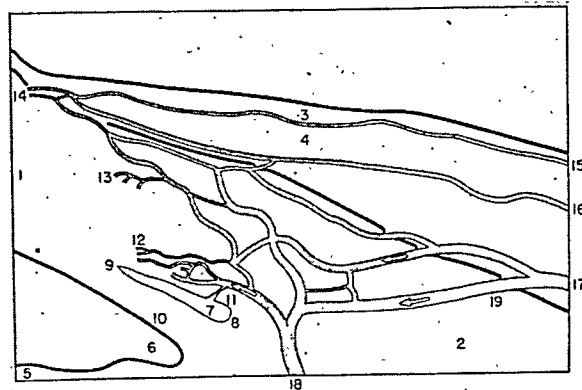


FIG. 8

Fig. 8 (Ascher). GLAUCOMA AND BACKFLOW OF BLOOD INTO THE CANAL OF SCHLEMM. In eyes with normal intraocular pressure, blood easily enters the canal of Schlemm and most probably does so during the negative glass-rod phenomenon. In eyes with primary compensated glaucoma, aqueous veins fail to show the positive glass-rod phenomenon. Gonioscopically, entrance of blood into the canal should be expected. Bangert and Goldmann, however, stated that in glaucomatous eyes blood rarely entered the canal. They found: In 50 eyes with normal intraocular pressure, 20 eyes showed backflow into the canal, whereas in 40 glaucomatous eyes, only 2 eyes showed the backflow. Backflow into the canal is more common in eyes with normal pressure. Narrowing of the outlets (11) may cause the absence of backflow into the canal and the absence of the positive glass-rod phenomenon in eyes suffering from primary compensated glaucoma.

traocular-fluid elimination than another outlet only one tenth as large. Presence or absence of visible fluid elimination in human eyes may well be due to differences in the size of the outlets in different individuals. The location of the visible fluid elimination, that is the site of an individual aqueous vein, most probably also depends mainly upon the size of the single outlet from the canal of

tention to the possible danger connected with damaging an aqueous vein during an eye operation.

Engorgement of the venous drainage as a possible cause of glaucoma has been discussed in a previous publication (see ref. 16, p. 1310). The possible influence of local, as well as systemic, increase of venous blood pressure on intraocular pressure was discussed, and the role of

the aqueous veins in pulsating exophthalmos and in facial hemangioma was mentioned along with the importance of aqueous veins for the fluid elimination in hydrophthalmic eyes.

Sugar stressed the fallacy of consider-

sideration that early signs of congestion may be found in practically every case of compensated glaucoma under biomicroscopic examination of the aqueous veins (see ref. 5, pp. 1076-1077). This certainly does not mean that the clinically so im-

TABLE 3
CLASSIFICATION OF SECONDARY GLAUCOMA
Modified from Sugar's table (1942)

-
- A. Failure of Osmotic Forces
 - 1. Arteriosclerosis in afferent vessels of the canal of Schlemm
 - 2. Obstruction of trabecular spaces
 - a. Glaucoma capsulare of Vogt
 - b. Pigment accumulation
 - c. Obstruction by cellular debris
 - d. Blocking by tumor growth
 - 3. Increased protein content of the aqueous humor (uveitis, trauma)
 - 4. Vascular changes and toxic effects of:
 - a. Vitreous hemorrhage
 - b. Occlusion of central retinal vein
 - c. Diabetic rubeosis of iris
 - B. *Occlusion of Aqueous Veins (Canal Outlets)*
 - 1. Keratitis
 - 2. Scleritis
 - 3. Tumor growth
 - 4. Narrowing or obliteration of outlets
 - C. Mechanical Closure of the Chamber Angle
 - 1. Shallow-angle glaucoma in:
 - a. Acute glaucoma
 - b. Glaucoma due to lens intumescence
 - 2. Glaucoma following cataract surgery from:
 - a. Blocking of the chamber angle
 - b. Obliteration of *severed aqueous veins* (canal outlets) (See B. 4)
 - D. Dislocation of the Lens
 - E. Lack of Communication between Posterior and Anterior Chambers
 - 1. Seclusio pupillae
 - 2. Total posterior synechia
 - F. Obstruction of Venous Drainage
 - 1. In the vortex veins
 - 2. *In the aqueous veins (canal outlets):*
 - a. Increased systemic venous pressure (Colomba)
 - b. Naevus flammeus of face
 - c. Pulsating exophthalmos
 - G. Local Hyperemia
 - 1. Traumatic glaucoma
 - 2. Reflex hypertonia (Magitot, Brault)
 - 3. Histaminelike reaction in epidemic dropsy
 - H. Congenital Anomalies
 - 1. Hydrophthalmos (malformation of the canal or/and of *its outlets?*)
 - 2. Juvenile glaucoma
 - 3. Neurofibromatosis
-

In this table, *italics* indicate the role of the aqueous veins. For explanation, see also previous publications. ^(5,16)

ing vascular congestion or lack of it as a criterion in the classification of glaucoma (see ref. 14, p. 329) and quoted Barkan as having the same opinion. This standpoint seems to be confirmed by the con-

portant distinction between compensated and congestive glaucoma should be disregarded. Its value for therapeutic decisions and for the choice of the operation cannot be overestimated. Fundamentally, how-

ever, it must be stated that, on biomicroscopic examination, early signs of vascular congestion are found in eyes suffering from an otherwise unquestionably compensated glaucoma (table 3).

AQUEOUS VEINS AS PATHWAYS OF DECOMPENSATION

Leber, Maggiore, and Theobald (see ref. 7) described collaterals, connecting both venous districts, which finally empty into the vortex veins and into the anterior ciliary veins, respectively. While the ma-

independent venous regions have rarely been mentioned in the glaucoma literature. They are, however, highly significant for the understanding of the mechanism of decompensated (or congestive) glaucoma (fig. 9).

With an increase in intraocular pressure, increasing quantities of blood that should leave the choroid by way of the vortex veins are forced into a collateral detour via the scleral plexus into the anterior ciliary veins. Thus, the venous return takes place partly through channels

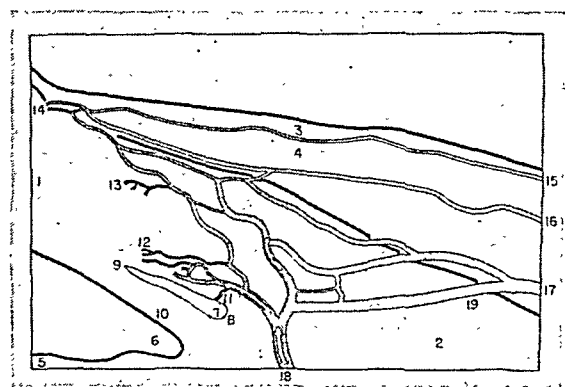
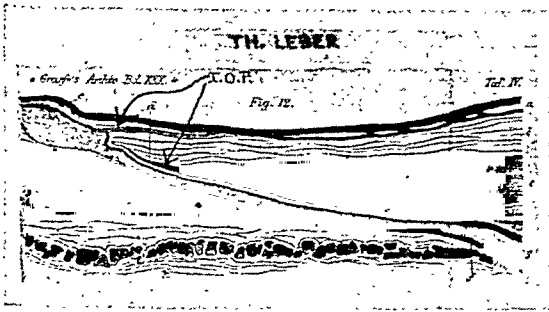


Fig. 9 (Ascher). AQUEOUS VEINS AS PATHWAYS OF DECOMPENSATION. *Drawing:* With increase of the intraocular pressure, the vortex veins become compressed (note arrow). *Diagram:* With compression of the vortex veins, blood is forced into the scleral meshwork (12, 13). Here it assumes a direction opposite to that of the aqueous outflow (arrows).

jority of the veins of the human ciliary body are drained into vessels which finally empty into the vortex veins, a part of the veins that leave the ciliary muscle pierce the sclera and empty into the anterior ciliary veins. Although seen and described by Leber, these connections are not clearly visible in his well-known scheme which has been reproduced in almost every textbook of ophthalmology. They are better visible in Maggiore's and Theobald's illustrations, as well as in Duke-Elder's reproduction¹⁹ of Maggiore's drawing, and in the reproduction of the same drawing published by Rollin²⁰ in the French "Traité d'Ophthalmologie." These connections between two otherwise

which normally do not take care of blood deriving from the choroid. Years ago, Heerfordt²¹ discussed the possibility that increased intraocular pressure may lead to compression of the intrascleral part of the vortex veins, an assumption which emphasized the importance of vortex veins and of their connections leading to the anterior ciliary veins for an understanding of the mechanism of congestive glaucoma.²² He assumed that increase of intraocular pressure may exert a valve-like effect on the origins of the vortex veins, forcing blood that normally should leave the vortex vein backward and into the anterior ciliary veins. Although Heerfordt's theory was not given much consent

(mainly because his hypothesis regarding the alleged valve-like effect on the vortex-vein origin was not confirmed), the significance of the collaterals connecting both venous regions (the one draining into the vortex veins and the other, emptying into the anterior ciliary veins) cannot be questioned.

It may well be that the nonappearance of the positive glass-rod phenomenon^{5, 16} in glaucomatous eyes can be considered, at least in some of the cases, an early sign of congestion in the collateral pathways which connect the drainage system of the vortex veins with that of the anterior ciliary veins. This reflection, however, should not preclude consideration of a possible narrowing of the outlets of Schlemm's canal, as described previously (see ref. 5, pp. 1083-1087).

THE CLEAR FLUID OBSERVED IN AQUEOUS VEINS IS NOT PRODUCED BY A SKIMMING OF RED BLOOD CELLS

One question remains to be answered. It might be doubted that the clear fluid seen in aqueous veins really is aqueous humor, sometimes clear, sometimes mixed with varying amounts of blood. Another interpretation might have been proposed; namely, that in the narrow vascular passages surrounding the corneoscleral junction of the human eye, a mere skimming off of plasma from red blood cells may occasionally take place. In this case, the clear fluid observed in aqueous veins would be blood, deprived of all, or of a part of, its red cells. In other words, it would be plasma without, or with a subnormal content, of red cells. I have rejected this hypothesis (see ref. 7, p. 1185) because of the anatomically recognized connections between the canal of Schlemm, the intrascleral vascular meshwork, and the episcleral and conjunctival veins. The phenomena observed after compression of the recipient vessels also favor the as-

sumption that aqueous humor is present in the aqueous veins. Vail proposed to reach a final decision by using fluorescein as a tracer. Before I could start on experiments of this kind, Goldmann¹⁰ succeeded in demonstrating that the limpid fluid streaming in the aqueous veins was not plasma but aqueous humor. He performed experiments on persons whose aqueous veins were very distinct. Five c.c. of a 10-percent solution of uranin, which is identical with fluorescein, were injected intravenously. Goldmann made his observations of the aqueous veins by means of a slitlamp microscope with its rheostat maximally opened and with intercalation of a Corning ultraviolet filter. Whereas vessels containing blood soon showed a yellowish-green hue, the aqueous veins remained clear and colorless. In recipient vessels, Goldmann was able to distinguish two or more parallel strata, a greenish, sanguineous phase and a colorless, aqueous one. Using a 20-diameter magnification, he saw a uniform greenish color only after a complete mixing of the aqueous and sanguineous phases, which took place a few millimeters beyond the junction of the aqueous vein and its recipient vessel.

Goldmann's observations, performed after intravenous uranin injection, proved that the aqueous veins contain intraocular fluid and not plasma, partly or completely deprived of red blood cells. After intravenous administration, uranin circulates with the blood, confined to the plasma. It would appear even in skimmed up plasma. Therefore, the lack of color in aqueous veins after intravenous administration of uranin leads to the conclusion that these vessels do not contain blood deprived of red blood cells but intraocular fluid with varying amounts of blood.

The response of animal and human eyes to oral and to parenteral fluorescein administration has been studied by several investigators. The most exact figures

seem to be those reported by Lindner²³ who, after oral administration of 4 gm. of uranin, observed normal human eyes with the aid of the corneal microscope. The interval between administration of the dye and its appearance in the anterior chamber was 15 to 30 minutes; the highest intensity of the green hue, however, was found 1½ to 2 hours after intake of the dye. This maximum lasted for one to two hours, and the complete resorption of the green color from the anterior chamber did not take place before one, or even two, days had elapsed. Using colorimeter tests, Lindner stated that the uranin concentration in the aqueous humor reached 1:8,000,000 to 1:3,000,000. In the initial stages of the experiments, the concentration of uranin was markedly higher in the blood as compared to that in the aqueous humor; later on, however, the uranin level of the aqueous humor surpassed that of the blood.

These observations would indicate that it is imperative to perform experiments, similar to Goldmann's, soon after the administration of uranin, especially if the dye is introduced intravenously; for by this method the interval between the administration of the dye and its entrance into the anterior chamber is shorter as compared to the interval observed after oral intake. In albinotic eyes, the green color appears in the anterior chamber while the uranin injection is being performed.¹³ The fact must be considered that uranin will pass through the blood-aqueous barrier twice: first, from the capillaries into the aqueous humor; then, from the aqueous humor into Schlemm's canal and possibly into intraocular capillaries which finally will return the dye into the venous circulation. If the wait is too long, it may be possible to see green color in the aqueous veins and none in the regular veins, indicating the resorption of the dye via the canal of Schlemm and the

intrasccleral meshwork. Up to the present time, this phenomenon has not been described.

Goldmann¹⁰ performed another important experiment to show that the contents of the aqueous veins are really aqueous humor and the aqueous veins are accessible from the anterior chamber of the human eye. In repetition of the famous animal experiments performed by Seidel (see ref. 7), Goldmann injected India ink into the anterior chamber of an eye that was to be enucleated because of a uveal sarcoma. Previous to the injection of the ink, an aqueous vein was located in the nasal episcleral region of that eye. After the instillation of a cocaine solution and the aspiration of a small amount of the aqueous humor contained in the chamber of the sarcomatous eye, an ana-partes mixture of saline solution and Guenther-Wagner Pertusche (a brand of India ink) was injected into the anterior chamber. The intraocular pressure was reduced after the injection of the ink and, although the regular episcleral vessels maintained their normal red color, the previously located aqueous vein showed a black tint.

Thus, for the first time, it was demonstrated that an aqueous vein could be filled with a material introduced into the anterior chamber. The most striking objection to Seidel's experiments using anterior-chamber injections was raised by Weiss who (see ref. 7) stated that this method could destroy natural barriers separating the anterior chamber from the canal of Schlemm or from intrasccleral veins, either during the preliminary aspiration of aqueous humor or during the injection of the dye. It is difficult to understand why this possible destruction should have occurred, in Goldmann's experiment, just on the site of the previously located aqueous vein which turned black while the regular episcleral veins

maintained their normal red color.

Both types of experiments (uranin administration and ink injection) prove that the aqueous veins are accessible from the anterior chamber, as well as that these veins really contain aqueous humor. They do not prove, however, that there is a free communication between the anterior chamber of the human eye and the canal of Schlemm.

VISIBILITY OF AQUEOUS VEINS WITHOUT THE USE OF THE CORNEAL MICROSCOPE

In most instances, the aqueous veins proper are too small to be recognized without the aid of the slitlamp microscope. Some of them, however,—namely, those that carry a stratified current and attain a diameter exceeding that of the smallest precapillaries—can be seen with a 10-diameter magnifying loupe under good focal illumination. Their size and the presence in the same vessel of a sanguineous and a clear phase make them readily recognizable with the aid of the loupe.

During the autumn of 1945 and the spring of 1946, 400 unselected patients with quiet eyes were examined for the presence of aqueous veins detectable without the corneal microscope. Of these patients (most of whom came in for a test of refraction) 57 showed aqueous veins when examined with the simple magnifying loupe. Thus, with the loupe 14.25 percent of all uncongested eyes were found to show aqueous veins; whereas, 26.78 percent showed them when observed under the slitlamp microscope.⁷

It should be mentioned that, with this method of examination, a recipient vessel might sometimes have been counted instead of an aqueous vein proper. The presence of a recipient vessel, however, always is indicative of the presence of an aqueous vein. It is, therefore, valid to assume as correct an estimate of 14.25 per-

cent for eyes showing aqueous veins (or at least recipient vessels) under loupe observation.

SEASONAL DIFFERENCES IN THE OCCURRENCE OF AQUEOUS VEINS

Although observation of the individual eye revealed the presence of one or of a few vessels charged with a continuous or intermittent elimination of aqueous humor (see ref. 1, p. 35; ref. 7, p. 1179), and although the same aqueous vein could be recognized after intervals ranging from a few months to 2½ years (see ref. 5, p. 1077),* the occurrence of the aqueous veins seemed to change with the seasons of the year.

The 400 patients mentioned were seen at different times of the year. Two hundred were examined during the months of November and December of 1945, and 200 during March and April of 1946. As has already been stated, these examinations were performed without the corneal microscope and with only a 10-diameter magnifying loupe under good oblique focal illumination. At this lower magnification, an average of 14.25 percent of easily visible aqueous veins (or at least recipient vessels of an aqueous vein) were observable. In the autumn group, however, the percentage of aqueous veins was only 10.0; whereas, in the spring group, it was as high as 18.5 percent.

The assumption that the occurrence of aqueous veins could vary seasonally does not explain this numerical difference. The histologic substrata of the visible intraocular-fluid elimination (see ref. 7, p. 1179) cannot possibly change with changes of climatic factors. What, however, may change is the degree of difficulty encountered in finding vessels differing in color from the regular conjunctival and subconjunctival veins. The visi-

* Since that time, aqueous veins have been observed up to a period of 4½ years.

bility of the aqueous veins and of their recipient vessels, may well be influenced by at least one of the climatic factors; namely, by seasonal differences in illumination (see ref. 7, p. 1200). An eye exposed to bright light often shows an increase of the clear fluid contained in its aqueous veins and, occasionally, even an increase of the speed with which the clear fluid is flowing in them; however, in many eyes, darkness produces the opposite effect—namely, an increase of the red-blood-cell content of the aqueous vein and, occasionally, a retardation of the flow in the aqueous vein. In this connection, I should mention that, in eyes blind from tabetic optic-nerve atrophy, I have often found an extremely slow movement of the fluid streaming in the aqueous veins. The greater degree of brightness of the sky during the months of March and April might be responsible for the greater ease of finding aqueous veins during these months than during the months of November and December. There may also be a connection between the ease of finding the aqueous veins and the occurrence of conjunctival diseases. The incidence of slight conjunctival irritations may be higher during the fall and early winter than in the spring; therefore, the well-known effect of conjunctival hyperemia on aqueous veins (see ref. 16, p. 1314) will make them appear less conspicuous, or even completely disappear, in those periods of the year when external factors favor the development of any kind of conjunctival hyperemia. This may serve to explain the difficulty encountered by some ophthalmologists in finding aqueous veins at all. In discussing the extremely rare observation of aqueous veins in the eyes of patients admitted to the Utrecht University Eye Clinic, Fischer¹³ agreed to my tentative explanation that, after so many months of starvation, the conjunctivas of all people coming to this Clinic

were more or less congested. Hyperemia in conjunctival or episcleral vessels tends to conceal the presence of aqueous veins by adding red cells to the clear stream. Therefore, anything that may increase the red-cell content in the aqueous veins will make recognition more difficult. If nutritional or climatic factors favor the incidence of even slight conjunctivitis cases, they may produce the impression of scarcity or even absence of aqueous veins by making the clear fluid indiscernible.

SUMMARY

In 1941, for the first time by means of the biomicroscope, aqueous humor was seen to stream through conjunctival and episcleral veins of the normal human eye. Vessels containing a clear fluid, sometimes mixed with varying amounts of blood, can be found in at least one third of all quiet human eyes with the use of the corneal microscope and slitlamp illumination. With the aid of a 10-diameter magnifying loupe and good oblique illumination, they are detectable in more than 14 percent of all eyes not injected. Emerging from the limbal meshwork, from the depth of the scleral tissue adjacent to the limbus, or from a scleral emissarium, these clear vessels join conjunctival or subconjunctival veins. In the recipient vessel, they produce either a marked dilution of its blood content or a characteristic pattern of stratification with two, three, or more differently colored layers that run parallel to one another along the vessel wall. The colorless vessels were termed aqueous veins. They are biomicroscopically visible pathways connecting Schlemm's canal and the intrascleral meshwork with conjunctival and subconjunctival veins. Not all quiet human eyes show aqueous veins owing to the fact that aqueous humor, upon leaving the canal of Schlemm, may become rapidly and completely mixed with the blood which is

contained in the intrascleral meshwork. If, however, clear fluid can reach the episcleral or conjunctival veins without the previous addition of too many red blood cells, an aqueous vein will become visible. Anatomic differences in the outlets of Schlemm's canal are rather definite, and it seems reasonable to assume that an outlet measuring 50 μ in diameter will be more important for the elimination of intraocular fluid than another outlet having only one tenth of this diameter. It is possible that, in some normal human eyes, a great number of outlets are constantly eliminating aqueous humor; whereas, in other eyes, only a few outlets or even only one, may carry the bulk of fluid. In eyes of the latter type, surgical or traumatic severing of one of these main channels may initiate a disastrous increase of intraocular pressure. The possible role of the aqueous veins in the etiology and classification of glaucoma was discussed. Observations on glaucomatous eyes led to the working hypothesis that a transient or permanent narrowing of the outlets of Schlemm's canal may be connected with the presence, or even may be responsible for the development, of increased intraocular pressure in certain eyes. Clinical observations and reflection suggest the significance of aqueous veins in the mechanism of decompensated glaucoma.

Many ophthalmologists have had difficulty in recognizing the aqueous veins; whereas, others have confirmed their occurrence and significance. Photographs of recipient vessels have corroborated the presence of highly diluted blood in these vessels, as well as the influence of drugs on the elimination of intraocular fluid through the aqueous veins.

Protracted observation of the veins surrounding the corneoscleral junction will always reveal that one or more individual

channels are continually charged with the elimination of intraocular fluid. Physiologic factors and climatic differences in part concur in their effect and in part exercise the opposite influence on aqueous veins. Once located, the particular aqueous vein remains discoverable at its original location after months and years, and retains its characteristic qualities. Apparent differences in the incidence of aqueous veins, when searched for with a 10-diameter magnifying loupe at different seasons of the year, are due to differences in the red-cell content and to the greater difficulty of recognizing an aqueous vein when there is conjunctival congestion. In eyes blind from tabetic optic-nerve atrophy, the movement of the fluid streaming in aqueous veins is often slow.

The question as to whether aqueous veins contain aqueous humor or blood deprived of all, or part, of its red cells, has recently been answered by Goldmann. He stated that, after intravenous injection of a 10-percent uranin solution, the aqueous veins remained colorless while the blood running in the recipient vessels, in conjunctival and in subconjunctival veins, showed the greenish-yellow hue of the dye. India ink, injected into the anterior chamber of an eye with a uveal sarcoma, appeared in a previously located aqueous vein only and not in any of the other vessels.

The physiologic and clinical significance of the aqueous veins should be acknowledged. The term aqueous veins should be accepted for the biomicroscopically visible part of the pathways which are charged with intraocular-fluid elimination from the canal of Schlemm via intrascleral meshwork to the conjunctival, subconjunctival, and anterior ciliary veins.

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DISCUSSION

SIR STEWART DUKE-ELDER, chairman (London, England): I should like to thank Dr. Ascher for his able presentation—not only an exceedingly interesting subject, but very important, and a subject on which there ought to be some study.

I want to ask him one question. You started off by eliminating the arterial system entirely. Do you agree with Dr. Friedenwald that there are direct arterial aberrant vessels in the canal of Schlemm.

DR. ASCHER (closing): I do not dare to answer that question because I do not have any pertinent experience of my own.

From the papers published on this subject, I do believe that it is very possible that these vessels described by Friedenwald are not only present but that they also fulfill the physiologic function as described or ascribed to them by Friedenwald.

EXPERIMENTAL DINITROPHENOL CATARACT*

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Cataract following the ingestion of dinitrophenol in human patients was first reported in 1935.^{1, 2} Within the following six years, 177 cases had been reported in the literature.³ The patients who developed dinitrophenol cataracts were obese, were almost all women, and were in a younger age group than those in whom cataracts were ordinarily seen.⁴ These facts suggest that variations in metabolism may be significant in the development of the cataracts.

Thorough experimentation on laboratory animals prior to the release of dinitrophenol for medical use was carried out by Tainter and his fellow workers at Stanford Medical School. Further careful work was done following the reports of dinitrophenol cataracts in humans. In no instance was it possible to produce cataracts in the ordinary laboratory animals (specifically rats, rabbits, guinea pigs, and dogs);⁵ nor was it possible to produce experimental cataracts on feeding dinitrophenol to animals deficient in vitamins A, B₂, or C.⁶ The incidence of cataracts could not be increased when dinitrophenol was administered in conjunction with such cataract-producing agents as lactose and galactose.⁷ These facts again suggested that variations in metabolism accounted for the failure of animals to develop dinitrophenol cataracts. It is significant that in all cases the species used were mammalian.

In 1944, Robbins⁸ reported that chickens and ducks on a diet of 0.25-percent

dinitrophenol developed marked lens opacities within eight hours. These lens opacities were sufficiently dense to be seen by the naked eye, although they cleared almost entirely within 24 hours after the dinitrophenol diet was started and while the birds were still on the 0.25-percent dinitrophenol diet. This work was quickly confirmed.⁹ The lens opacities were limited to the anterior and posterior subcapsular regions. The posterior subcapsular area was more densely opaque than the anterior. The nucleus and the remainder of the lens cortices remained entirely clear. No abnormalities other than in the lens were noted by slitlamp microscopy. The opacities developed in 100 percent of young chicks on the 0.25-percent diet, but with less regularity in older chickens on the same concentration of dinitrophenol.¹⁰ They even developed on concentrations of dinitrophenol as low as 0.05-percent, but with less frequency.

Now, at long last, experimental dinitrophenol cataracts had been produced, but they had been produced in avians, not mammals, and they were transient, not permanent.

EXPERIMENTS ON OBESE MICE

One of the significant facts in human patients who developed dinitrophenol cataracts is that they were all obese. In previous experimental studies, obese animals had never been used. To determine whether or not factors associated with obesity may play a part, a strain of congenitally obese mice was fed dinitrophenol. These adipose mice have been used for studies in obesity for the past 20 years.¹¹ The mice were all yellow, and

* Study conducted under a grant from the Francis I. Proctor Fund. Division of Ophthalmology, Stanford University Medical School, San Francisco. Read before the Association for Research in Ophthalmology, Inc., at San Francisco, July 2, 1946.

the gene for adiposity was apparently associated with the yellow color. They were all heterozygotes since the yellow gene is lethal when homozygous. In conjunction with the adiposity, and probably responsible for it, was a definite tendency for the yellow mice to eat more and be less active, as is often the case with adipose humans.¹² In all other respects, the obese yellow mice did not seem to differ from the ordinary nonobese varieties.

In this experiment, 40 fat, yellow mice were put on their usual diet of Tioga meal, but 0.1-percent dinitrophenol was mixed with it. Forty control fat, yellow mice were placed on the diet of Tioga meal without the dinitrophenol. The dosage of 0.1-percent dinitrophenol in the diet was selected because this was previously determined by Tainter¹³ as a concentration sufficient to decrease the growth rate and final weight without decreasing the life span of white rats. This concentration, therefore, was believed to be sufficient to affect the metabolism without being lethal to the yellow mice.

The animals used were 8 to 10 months old (younger middle age). They were examined by slitlamp microscopy before the experiment was started and at periodic intervals thereafter; they were weighed weekly. Many mice present fine, suture-line opacities that do not develop into immature or mature cataracts and occur regardless of skin color, weight, or diet. In the light of this fact, these fine, suture-line opacities were ignored.

Three of the 40 mice on the diet with dinitrophenol developed cataracts that were immature within four to eight weeks after the diet was started. These cataracts were first seen as fine posterior subcapsular opacities; then the nucleus became milky in association with the development of definite cortical spokes. No other pathologic changes were observed

in the eyes with the development of the cataracts. None of the 40 control animals from the same colony developed cataracts.

Although the incidence of three cataracts out of 40 animals on dinitrophenol (7½-percent) is admittedly small, this is comparable to the incidence of thallium cataract in rats, which is 11 percent.¹⁴ It is also comparable to the incidence of 7.4-percent cataracta raphanica in patients with ergot poisoning.¹⁵ The incidence of 7½-percent of dinitrophenol cataracts in congenitally obese yellow mice is definitely higher than the presumed incidence of dinitrophenol cataract in humans. This has been estimated to be 0.86-percent by Horner.⁵

The time of onset of the cataracts in the obese mice (four to eight weeks after the dinitrophenol was started) was also comparable to the time of onset of thallium cataract in rats (six weeks).¹⁴

In human subjects, cataract formation often occurred with dramatic suddenness some time after the dinitrophenol was discontinued. In order to determine whether or not a comparable phenomenon would occur in the congenitally obese mice the dinitrophenol was discontinued in 13 of the mice after six months of dinitrophenol diet. In no instance did cataract formation occur during an additional four months' period of observations.

EXPERIMENTS ON OTHER MICE

As previous experimental work with dinitrophenol feedings had been performed on mammals other than mice, it was necessary to demonstrate that cataracts did not develop in ordinary mice that were not obese. Twenty albino mice were put on a 0.1-percent dinitrophenol diet and 20 albinos were kept as controls. Twenty black mice were also placed on the 0.1-percent dinitrophenol diet, to rule out possible differences due to pigmentation.

tion. No cataracts developed except for one albino mouse which developed a cataract just before its death after 11 months of dinitrophenol feedings. This is not comparable to the cataracts which developed after only four to eight weeks in the younger mice.

The question logically arises as to why chickens are so much more susceptible to the formation of dinitrophenol cataracts than are the obese mice. Is this difference due to higher dosages of the drug used in some of the chickens? Is it due to the difference in age of the chicks and the mice, or is it due to differences in the temperatures of the two species? In an attempt to answer these questions, the following experiments were performed.

Although a 0.25-percent dinitrophenol diet is lethal to mice within a short time, experiments were undertaken to determine whether this dosage would produce cataract formation in mice within less than 24 hours as had occurred in chickens.

Six ordinary albino mice were put on a 0.25-percent dinitrophenol diet. They were examined before the diet was started and eight hours later. No cataract formation was present in any of the mice at this time. All six died shortly thereafter, as the dosage of 0.25-percent dinitrophenol was lethal. Six congenitally obese yellow mice were put on the same diet and examined at the same intervals. Their eyes also remained clear, and they likewise died shortly after the eight-hour period. We may conclude that 0.25-percent dinitrophenol does not cause rapidly developing cataracts in either obese or ordinary adult mice, although it did cause this type of cataracts in chicks.

In view of the fact that young chicks were more prone to develop cataracts than adult chickens, five-to six-week-old mice were also put on 0.25-percent dinitrophenol. All eight of the mice were free of cataracts nine hours after the diet

was started. The 0.25-percent dinitrophenol diet was continued for one week, and repeated observations were made during this time. At the end of this period, two of the mice had died, but all were free from cataract formation. The age of the mice, then, did not seem to be a factor in the development of the type of cataract observed in chickens on a dinitrophenol diet.

EFFECTS OF TEMPERATURE

The normally higher avian body temperature suggested that this may have been a factor in the predisposition of the chicks to cataract formation while on a dinitrophenol diet. It had already been shown that the toxicity of 2:4 dinitrophenol on mice is increased by raising the environmental temperature to 40°C. and lowered by decreasing the environmental temperature to 6°C.¹⁶ Accordingly, 10 congenitally obese yellow mice were placed in an incubator with the environmental temperature kept at 38 to 38.8°C. Five of the group of 10 mice were also put on a diet of 0.25-percent dinitrophenol, while the other five were kept in the incubator on a normal diet as controls. The body temperatures of the incubated mice on DNP were variable but tended to be higher than the readings noted in other group. After eight hours of incubation of both groups, neither the one on dinitrophenol nor the one without it developed cataracts upon examination by slitlamp microscopy. All of the mice subjected to both incubation and dinitrophenol died shortly thereafter and, consequently, the experiment could not be continued. Differences in temperature, then, did not seem to be the factor which accounts for the difference in the susceptibility of mice and chicks to transient cataracts.

One cannot draw definite conclusions from an experiment in which only 3

of 40 obese mice developed cataracts in two months or less. Nevertheless, the absence of cataract formation in thin mice (except one moribund mouse which had been on therapy for almost a year) suggests that obesity may be a definite factor in cataract formation associated with dinitrophenol therapy. It was necessary to work with relatively small numbers of mice because of the need of numerous time-consuming slitlamp examinations.

As previous studies had demonstrated that chicks on a diet of 0.25-percent dinitrophenol developed a transient cataract within eight hours, the question naturally arises as to why the chickens are markedly susceptible to a transient dinitrophenol cataract, whereas obese mice are slightly susceptible to a permanent dinitrophenol cataract, and other mammals are not at all susceptible. It was not the dosage, since chicks develop cataracts on concentrations as low as 0.05-percent, although with less regularity, and mice do not develop the cataracts on concentrations as high as 0.25-percent. It is not the age factor, because old chickens do develop dinitrophenol cataracts, whereas young mice on comparable doses do not develop them. It probably is not the higher body temperature of avians, for mice placed in an environmental temperature of 38° to 39°C. did not show cataracts while on the 0.25-percent dinitrophenol diet.

It may be that the transient opacity in the chick is due to a relative anoxia produced by the dinitrophenol, since dinitrophenol increases the oxygen consumption. Cataracts have been produced in a decompression chamber in rats and rabbits.^{14a} It may be that this effect is due to an increase in the lactic acid, which was also demonstrated under these circumstances. One may speculate that this produces a colloidal change which has

not gone far enough to be irreversible.

DIRECT INJECTION EXPERIMENTS

We now may ask the question: Is the transient cataract produced in chicks by dinitrophenol a direct effect of the drug on the lens, or it is due to some product, toxic to metabolism, resulting from the ingestion of dinitrophenol? Is there a difference in susceptibility of the avian lens and the mammalian lens to dinitrophenol cataract, or is this apparent difference due to factors elsewhere than in the lens?

To answer these questions, sodium 2:4 dinitrophenol was injected into the anterior chambers of young chickens. Dense anterior subcapsular cataracts were found 20 to 40 minutes after the direct injection of the dinitrophenol. The solutions of dinitrophenol had been rendered isotonic and buffered to pH 7.3, and were used in dilutions of 1:1,000, 1:5,000, and 1:50,000. A control solution of the agents used to attain isotonicity and the buffered state was injected into the opposite eye of each chick and in no instance did a cataract occur. The average quantity used was 0.04 c.c., and the injection was preceded by withdrawal of the same amount of aqueous. The cataracts were exceedingly dense when unbuffered 1:1,000 dinitrophenol was used; somewhat less dense when buffered 1:1,000 dinitrophenol was used; and even less dense, but very definite, when the buffered 1:5,000 solution was used. The 1:50,000 solution did not cause cataracts when injected in the usual quantity of 0.03 to 0.05 c.c.

Twenty-four hours after the injection these lens opacities had cleared almost completely. Seventy-two hours after the injection, the lenses were entirely clear.

EXPERIMENTAL PROCEDURE

Four- to eight-weeks-old, white-leghorn female chicks were used. The eyes were examined

by slitlamp microscopy preceding the injection and were found to be clear in all instances. The chicks were anesthetized with ether, and 0.5-percent tetracaine drops were instilled locally. After puncture through the cornea with a 30-gauge needle and a tuberculin Luer without injuring the iris or lens, 0.03 to 0.05 c.c. of aqueous was withdrawn. Through the same corneal-puncture wound, 0.03 to 0.05 c.c. of the sterile solutions described above was injected. The chickens were examined by slitlamp microscopy at intervals of 15 minutes after the injection for the first two hours, and again in 24 hours and 72 hours.

Within the first 15 minutes, no lens changes were found, but the secondary aqueous was cloudy in both the eyes injected with the dinitrophenol and those injected with the buffer solution used as a control. Approximately 30 minutes after the injection, the dinitrophenol-instilled eyes revealed definite anterior subcapsular opacities. These increased in the succeeding 15 to 30 minutes and then remained unchanged. In some instances a fine posterior subcapsular opacity appeared to be present, but the remainder of the lens was always clear. Twenty-four hours after the injection, the lenses were almost entirely clear except for a very fine anterior subcapsular opacity in some instances. Seventy-two hours after the injection all lenses were entirely clear. In no instance did the control eye exhibit any lens changes.

The buffer-control solution and buffered-dinitrophenol solutions were prepared by the Barnes-Hind Laboratories of San Francisco, as follows:

1. A phosphate buffer solution of pH 7.3 was made according to the following formula:
Sodium acid phosphate ($\text{NaH}_2\text{PO}_4 \cdot \text{H}_2\text{O}$)

Disodium phosphate (Na_2HPO_4)	1.747 gm.
Sodium chloride	7.653 gm.
Distilled water q.s.	3.90 gm.
pH adjustment: 7.3 plus or minus	1,000 c.c.
0.02 pH unit	(24°C.)

Freezing point depression -0.569°C .

2. Sodium dinitrophenol solutions: The following concentrations of sodium dinitrophenol were prepared in the above buffer:

- a. 1:1,000
- b. 1:5,000
- c. 1:50,000
- d. 1:200,000

Preparation: A 1-c.c. ampul was filled with these four concentrations and also a 1-c.c. ampul containing the phosphate buffer alone as controls. The sealed ampuls were autoclaved at 120°C . for 20 minutes for sterilization. Ampuls from each concentration were checked for sterility on thio-glycolate media. All cultures were negative.

It is of interest to compare the concentration of dinitrophenol, which caused a definite cataract when injected into

the anterior chamber, with the concentration probably attained after ingestion of sufficient dinitrophenol to cause a definite cataract in the chick. Direct injection of 0.04 c.c. of 1:5,000 dinitrophenol solution consistently produced a cataract. The ingestion of 110 gm. of 0.25-percent dinitrophenol by a 440-gm. chick likewise consistently produced a cataract. If all the dinitrophenol were absorbed, and if it were equally distributed throughout the body, a concentration of 1:1,600 would result. As complete absorption and equal distribution are extremely unlikely, it is probable that the concentration produced by direct injection and by ingestion are similar.

In the light of the fact that dinitrophenol produces cataract by direct injection, and that the concentration which causes cataracts by this method (1:5,000) is comparable with the concentration resulting from ingestion (1:1,600), it is suggested that the effect of dinitrophenol upon the chicken lens is a direct action not dependent upon any intermediate product of metabolism.

It next remained to be determined whether the failure to obtain cataracts from dinitrophenol in most mammals was due to a difference in the reaction of the lens itself to the dinitrophenol or to a difference in the metabolism of dinitrophenol in the mammal as compared with the avian species. The direct injection of dinitrophenol solutions into the eyes of rabbits was, therefore, performed. The injections were done in precisely the same manner as described in connection with the chicks, except that a larger quantity (+0.10 c.c.) was injected, because the anterior chambers were larger. The same type of anterior subcapsular cataract occurred in the same length of time and cleared completely as was the case with the chicks, although the opacity

was not quite so marked in the rabbits as in the chicks.

Rabbits, as well as other mammals, had previously been subjected to feeding experiments with dinitrophenol and, in all cases, no cataracts developed. In order to confirm the absence of cataract formation in rabbits, when fed the same concentration of dinitrophenol as chicks, rabbits were placed on a diet of 0.25-percent dinitrophenol. Although this concentration produced a cataract within eight hours in the avian, it failed to produce any lens changes in the rabbit in eight hours, or at any period thereafter until the observations were discontinued after four weeks.

It is suggested that the failure to obtain cataracts in most mammals is due to a difference in metabolism as compared with the metabolism of avians, and not to a difference in the lenses themselves.

EXPERIMENTS ON LENS

The next obvious question is whether the action of dinitrophenol is an interference with the metabolism of the living lens or whether it also affects lens tissue *in vitro*. Lenses were removed from chickens, fat mice, and rabbits immediately after the animals had been killed. Removal was effected without injuring the lens capsule and the lenses were immediately immersed in solutions of buffered isotonic (1:1,000) dinitrophenol, unbuffered nonisotonic (1:1,000) dinitrophenol, and a control solution of the buffer material. In no instance could lens opacities be observed within two hours in the lenses from any of these species in any of these solutions. The examinations were performed by slitlamp microscopy in the same manner as in the living eyes as well as by other methods of magnification.

We must assume from the foregoing,

that dinitrophenol acts only on the living lens and does not produce cataract *in vitro* with comparable concentrations and in a comparable time.

SUMMARY

Dinitrophenol is estimated by Horner to be associated with the development of cataracts in obese humans in an incidence of 0.86-percent. It is associated with the development of cataracts in obese mice in an incidence of 7.5-percent. The cataract has often occurred in humans after the withdrawal of dinitrophenol therapy; it does not occur in obese mice after the withdrawal of dinitrophenol. It did not occur in ordinary nonobese mice under any circumstances.

Dinitrophenol causes lens opacities in fowl within eight hours after a diet containing dinitrophenol is started. The opacities clear spontaneously while the fowl are still on the diet. In comparable dosages, dinitrophenol failed to cause lens opacities in young or adult obese mice whether or not they were placed in higher temperatures.

The direct injection of dinitrophenol into the anterior chamber of chickens and rabbits causes lens opacities in each within approximately one-half hour. The opacities clear within 24 hours. Rabbits do not develop lens opacities when fed dinitrophenol.

The direct immersion of the lenses of chickens, obese mice, and rabbits in a solution of dinitrophenol does not cause an opacity in a comparable length of time.

CONCLUSIONS

The results of these experiments lead to the following conclusions and conjectures:

1. Dinitrophenol acts only on the lens *in vivo* of mammalian as well as avian species.

2. Lenses *in vitro* did not develop this opacity. This may be because: (a) dinitrophenol, when in the anterior chamber, forms another compound which then acts on the lens, or (b) the permeability of the lens capsule is different when the lens is *in vitro* as compared to its normal state, or (c) dinitrophenol interferes with some phase of metabolism of the living lens, such as causing an increased need for oxygen or producing more lactic acid.

3. The failure of mammals to develop the transient opacities observed in fowl is due to a difference in metabolism of the species; it is not due to a difference in the lenses themselves.

4. The variations due to metabolism are confirmed by the occasional occurrence of permanent cataracts in congenitally obese mice. Such opacities did not occur in nonobese mice. This frequency of cataract formation is comparable to the incidence of cataract in obese humans and may explain the previous failures

of numerous investigations to produce cataracts in experimental mammals.

5. The difference in incidence of cataracts in fowl and mammals is apparently not due to the difference in body temperature. The age of the animal is little, if at all, related.

Numerous questions related to dinitrophenol cataract remain unanswered. Is the cataract-producing action of dinitrophenol due to its effect on oxidation or on sugar metabolism or to something else? Why does the cataract which develops so rapidly in a chick clear spontaneously while the chick is still on the same concentration of dinitrophenol? Why did cataracts occur with great rapidity in human subjects months after the ingestion of dinitrophenol had been discontinued?

Work is being continued in an attempt to answer some of these vexing problems.

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DISCUSSION

DR. CLYDE A. CLAPP (Baltimore, Maryland): As a member of the Commission, I should like to ask how many of the males developed dinitrophenol cataract. Are there any in the literature?

The second question is: What was the difference with the slitlamp in the so-called reversible opacities in the avians, and the permanent opacities that occurred in the mice?

DR. BETTMAN: There have been reports of dinitrophenol cataracts in human males in one or two instances. I have forgotten the precise number in the literature. It was not common, but it has been reported.

The slitlamp picture of the reversible cataracts in the chickens was a dense opacity entirely limited to the subcapsular layers of the lens. The remainder of the lens was not at any stage involved.

In the permanent opacities of the mice, the first observable change was the same type of subcapsular opacity, posterior at first, and then anterior; in association

with the development of the anterior opacity, or at about that stage, the nucleus begins to get a bit milky and then an opacity develops in the entire lens.

DR. CONRAD BERENS (New York, New York): I should like to ask one question. Are the terms "dinitrophenol" and "dinitrocresol" synonymous? A clinician in New York claimed a difference, but two obese women patients who were treated with dinitrocresol developed cataracts rapidly. One was 28 years old, and the other was 60 years old.

DR. BETTMAN (closing): The term "dinitrophenol" and the term "dinitrocresol" are not synonymous, but the drugs act, so far as we know, in precisely the same manner. Clinically, dinitrophenol has largely been used in the United States and dinitrocresol has been used largely in Europe. They both produce cataracts, and, as far as I know, they both act in the same manner. The group is usually called "dinitro bodies," because they are so similar in their action.

CATARACTA GLAUCOMATOSA ACUTA*

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Since Vogt¹ first described the entity which he named "Cataracta disseminata subcapsularis glaucomatosa" or "Glaukomflecken" in 1930, only five reports of the condition have been made. No cases have been described in the English or American literature. For this reason, and because of the case with

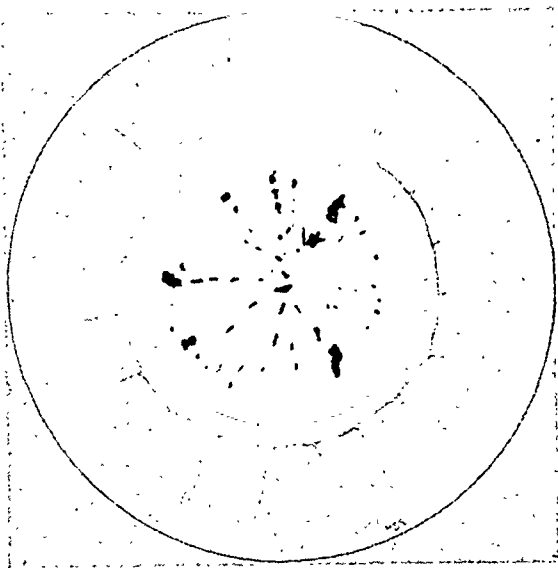


Fig. 1 (Sugar). Diagrammatic drawing of cataracta glaucomatosa acuta (case 5).

which their presence may confuse the diagnosis of acute glaucoma during a congestive attack, six cases are herein reported.

This form of cataract consists of multiple, circumscribed, white spots of characteristic irregular form and radial arrangement lying beneath the anterior lens capsule. Their color varies from the bluish translucency of very thin lens opacities to a more porcelainlike whiteness. If seen during an acute glaucomatous attack,

the lesions are very white. When the intraocular pressure has been reduced, their color is much less intense, and their transparency is increased. The spots have been seen in only the anterior subcapsular cortex, never posteriorly. They do not extend beyond the pupillary zone. None has ever been described as occurring in the region of iridectomies. The axial area is always involved. Here the spots are rounded or dumbbell-shaped and often larger than elsewhere. More peripherally, they are elongated to follow the suture lines of the lens. At the pupil border where the lesions end, the spots are again often large (fig. 1). In general, they vary in size from 0.3 mm. to less than 0.02 mm. (Vogt).

These lens opacities do not change in size with the passage of time. However, since they decrease in intensity immediately after the acute episode with which they are associated, it is conceivable that the very faintest spots may disappear. Once the acute episode is entirely over, the spots do not change in size or color. They do not interfere with the shagreen of the lens. During and immediately after the acute episode, the lesions lie just underneath the capsular epithelium. Later, with the formation of new lens fibers, the spots are pushed deeper into the cortex. Vogt observed in one case that, after five years (from the age of 53 to 58 years), the opacities were 0.5 mm. within the lens cortex. In two cases seen by me at about the time of the acute episode and again after eight years and six years, respectively, the spots occupied a level within the lens cortex equivalent to two thirds of the thickness of the cornea.

There is no significant visual impair-

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ment due to the presence of these thin lens opacities.

The occurrence of lens opacities which Vogt described in his original report was associated only with acute glaucoma. However, since that time, he² observed similar opacities in a patient after a severe contusion of the bulb. Similar cases have since been observed by Bücklers (1934),³ Van Lint (1937),⁴ and Sommer (1940).⁵ In each of these cases, however, there was evidently a momentary severe ocular hypertension, so that the term "Cataracta glaucomatosa acuta" may still be applied to them. Actually, both types are forms of traumatic cataract. The use of the designation "glaucomatosa acuta" is important to distinguish the entity herein described from other forms of cataract in glaucomatous individuals. Seidenari⁶ has included both types in the term "Cataracta glaucomatosa."

The relation between the lens opacities and the acute episode is evident from the fact that the lesions lie directly subcapsularly immediately after the episode. In a case of Kovarskaya and Krolh,⁷ the lens was found to be entirely normal when seen two days before an attack of acute glaucoma, following which the opacities were found. Vogt found 14 instances of these opacities among 74 patients with acute glaucoma which were seen by him between 1930 and 1937.

Vogt believed the lens opacities to be due to exudation. My own view is that the lesions are due to traumatic dissolution of the most delicate terminal portion of the lens fibers at the suture areas, in the uncushioned pupillary area of the anterior cortex. This would account for the radial arrangement of the opacities. The edema present during the acute attack would account for the more intense whiteness during that time.

The diagnosis depends on accurate biomicroscopy with the slitlamp and micro-

scope. Correct diagnosis has importance during an acute glaucomatous attack, since the opacities may be mistaken for exudate on the anterior capsule in the presence of marked corneal edema. This occurred in one of my cases. In two others, a diagnosis of capsular exfoliation



Fig. 2 (Sugar). Stereophotograph of subcapsular opacities in an eye that had suffered an attack of acute glaucoma.

had previously been made. All three of these patients were seen by me within a period of three weeks.*

Recognition of "Glaukomflecken" may also aid in establishing a definite diagnosis of previous acute glaucoma in an eye in which an acute attack has been completely relieved, as occurred in a case described by Weill and Hordman.⁸ It would be possible also to recognize two or more previous attacks in the same eye, if the attacks were severe enough to cause the lens lesions, and if a sufficient time interval were to elapse between the separate attacks for new, clear, lens fibers to form.

CASE REPORTS

Case 1. A. K., a 50-year-old woman, was first seen by me in February, 1938. She stated that for a period of several months redness and aching of the right eye recurred in the late afternoon and after reading or seeing motion pictures.

* Since writing this paper, two additional cases of "Glaukomflecken" have been observed, one after an interval of five years following an acute glaucomatous attack; the second, a recent case which had previously been considered to be glaucoma capsulare.

One week before admission to the Illinois Eye and Ear Infirmary (February 21, 1938), the right eye had become red and painful and remained so. On admission, the visual acuity of the right eye was reduced to perception of hand movements; that of the left eye was normal. Tonometric readings were: R.E., 60 mm. Hg (Schiotz); L. E., 19 mm. In spite of the intensive use of eserine, the intraocular pressure in the right eye could not be reduced satisfactorily. On February 25, 1938, an iridectomy was, therefore, performed. The tonometric readings thereafter always remained normal. The patient was followed by me for a period of three years and then again examined in April, 1946. Definite "Glaukomflecken" were present in the anterior cortex at a depth equal to about two thirds of the corneal thickness.

Case 2. J. K., a man, aged 44 years, was first seen by me in December, 1940. He had experienced severe pain in the right eye for the past five days. Treatment with miotics had been started on the third day but was ineffective. On admission to the Illinois Eye and Ear Infirmary (December 23, 1940), the tonometric reading for the right eye was 80 mm. Treatment with miotics continued to be ineffective. An iridectomy *ab externo* with incarceration of the iris was performed on the day following admission. The intraocular pressure remained normal thereafter. The patient was seen again in April, 1946, at which time typical "Glaukomflecken" were present in the anterior cortex at a depth equal to about two thirds of the corneal thickness.

These first two cases are cited to show the typical change in relative position of the lens opacities as time passes. In both of these cases, the depth of the opacities was approximately the same, equivalent to two thirds of the thickness of the corneal stroma near its apex.

Case 3. J. K., a woman, aged 50 years, was first seen at the Illinois Eye and Ear Infirmary on January 28, 1946. She complained of having had pain and redness of the right eye and severe supraorbital and temporal headache for the past three weeks, following a severe episode of influenza. The cornea of the right eye was steamy, the pupil dilated to 7 mm., and the tonometric reading was 57 mm. Hg (Schiotz). After clearing of the cornea with glycerin, the anterior chamber was found to be very shallow. The aqueous was clear. Opacities in the region of the anterior capsule were interpreted to be capsular exfoliation. Some excavation at the upper temporal border of the disc was believed to be present. The left eye showed no evidence of capsular exfoliation nor lens opacities.

The patient was treated intensively with eserine without effect. An iridencleisis was successfully performed on January 30, 1946, at the Chicago State Hospital, where the patient was being treated for involutional melancholia. She was first seen by me two weeks later, at which time the right lens opacities were found to be typical cataracta glaucomatosa acuta.

Case 4. Mrs. E. S., aged 65 years, was first seen by me on February 28, 1946. Four weeks previously she had experienced slight attacks of blurred vision with slight aching around the left eye. One week later, a severe attack occurred and persisted. The right eye had been enucleated following similar attacks of blurred vision and subsequent antiglaucoma surgery. Vision in the left eye was 20/200, with and without correction. A caput-medusa type of conjunctival injection was present. The pupil was dilated and the anterior chamber was found to be shallow. "Glaukomflecken" were present. They had been interpreted as capsular exfoliation. The disc was normal. The

tonometric reading was 60 mm. Hg (Schiøtz). Intensive treatment with eserine was ineffective, so an iridectomy-iridencleisis was performed. The opacities on subsequent examinations showed less intense color but did not change significantly otherwise.

Cases 3 and 4 are interesting in that both had been previously diagnosed as capsular exfoliation. During the acute attack, the subcapsular position is, of course, difficult to ascertain, but the presence of changes in the center of the pupillary area is a pathognomonic sign of cataracta glaucomatosa acuta in contradistinction to capsular exfoliation.

Case 5. Mrs. A. H. M., aged 49 years, was first seen by me on February 22, 1946. Three weeks earlier, while vacationing in another state, she had awakened with severe headache. She was treated for nearly three weeks with atropine and penicillin. During the past three days, she had received eserine instead. Examination revealed a reduction of visual acuity in the left eye to perception of hand movements at 1 foot. The cornea was markedly steamy. Glycerin dehydration was ineffective in clearing the cornea. Pigment deposits were visible on the posterior corneal surface. The anterior chamber was only slightly shallow. Whitish spots appeared to be present on the lens capsule. In view of the history, I interpreted the hazy spots to be exudate. The tonometric reading with the Gradle-Schiøtz tonometer was 60 mm. Hg. Intensive treatment with eserine was instituted but was ineffective in reducing the intraocular pressure. An iridectomy-iridencleisis was done on February 22, 1946. Since then, the vision has returned to 20/25 with correction, and the tension has remained normal. The first post-operative examination revealed that the capsular spots were typical subepithelial lens opacities (fig. 1) of cataracta glau-

comatosa acuta. These were less intense in color than during the acute attack. No evidence of primary uveitis was present.

Case 5 is an example of a mistake in diagnosis resulting from the presence of "Glaukomflecken." In this instance, the first oculist who saw this patient probably used atropine as a result of making the same mistake. Fortunately, the history of ineffective use of atropine for a relatively long period pointed out the correct treatment.

Case 6. Mrs. J. P., aged 59 years, was examined by Dr. S. J. Meyer on June 9, 1941. She was found to be 3.75 diopters hyperopic in each eye. Tonometric readings were: R.E., 24 mm.; L.E., 17 mm. Hg (Gradle-Schiøtz). An hour after instillation of euphthalmine for retinoscopy, the readings were: R.E., 22 mm.; L.E., 20 mm. No lens opacities were present. On April 10, 1946, she was seen by Dr. Meyer and me. She had had no ocular difficulty until 12 days previously, when she began to have headaches on the left side. Vision of the left eye was blurred. On the following day an antiglaucoma iridectomy was performed for acute glaucoma.

Upon examination, on April 10, 1946, large typical "Glaukomflecken" were found under the left anterior capsule. The tonometric reading in this eye was 22 mm. Hg (Gradle-Schiøtz).

Case 6 differs from the other three recent cases described in that the patient had symptoms only one day before surgical intervention. In the other three, the attack had lasted three or four weeks before intervention. It is, therefore, unlikely that a long period is required to produce the lens opacities. In many other cases of acute glaucoma with high tension, even those untreated for several weeks, no "Glaukomflecken" have been seen. The histories in the cases of traumatic "Glaukomflecken" indicate that a momentary

very high increase of intraocular pressure may be all that is required for their development.

In this case, the previous examination in 1941 revealed no pathologic condition of the lens, thereby indicating the relation between the acute episode and the presence of the lens changes.

CONCLUSIONS

Six cases of cataracta glaucomatosa acuta are reported together with a summary of the literature. The condition is important chiefly in differential diagnosis and in establishing the diagnosis of a previous attack of acute glaucoma.

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DETERMINATION OF OCULAR TENSION AND RIGIDITY IN RABBITS*

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Because of the insufficient data in the literature on the subject of this communication, it was deemed necessary to evaluate the normal range of ocular tension and rigidity in rabbits under varying physiologic conditions prior to experiments on changes of ocular pressure and tension.

There are two accepted methods of determining intraocular pressure; namely, the manometric and the tonometric. For purposes of comparative studies over a long period, the tonometric method was considered preferable.

METHODS AND MATERIALS

Twenty rabbits of both sexes of New Zealand and Checkered Giant varieties, varying in age from one to two years, were used. Ocular tension and rigidity were ascertained by a Schiøtz tonometer which had been standardized at the New York checking station. The third corrected curve of Schiøtz was used.

The eye was anesthetized with one drop of 1-percent butyn. To ascertain ocular rigidity, tension was obtained with two weights, the 5.5-gram and the 10-gram. Whenever two readings with the two weights did not reveal significant differences, the rigidity was assumed to be normal. A higher tension with the 10-gram than with the 5.5-gram weight indicated an increase in rigidity; a lower tension, a decrease.

* From Toledo Hospital Institute of Medical Research. This work was supported by a grant from the Snyder Ophthalmic Foundation.

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During the first phase of the experiments, the normal values were determined over a period of three weeks. The second phase of the experiment consisted in instilling into the eyes a solution of 1-percent paredrine, 1-percent pilocarpine, and 1-percent atropine. The drugs were introduced in single drops three times over a 15-minute period. The readings were made in 30 minutes and in four hours.

The third phase of the experiment consisted in the determination of ocular tension and rigidity by hypotonic (distilled water), hypertonic (4-percent saline), and isotonic (0.9-percent saline) solutions. These solutions were given by stomach tube in 40-c.c. volumes per kilogram of body weight. Readings were made over a period of four hours at 5- to 10-minute intervals.

Averages and standard deviations were evaluated in all experiments. Application of the following formula determined whether the findings obtained in the various experiments were significant. Differences were considered significant when they were larger than $3\sqrt{SE_{MX}^2 + SE_{MY}^2}$.

SE—standard error of the distribution of the magnitudes.

M—arithmetic mean.

x—varying abscissal value.

y—varying ordinate value.

TABLE 1

NORMAL OCULAR TENSION IN MM. HG AND RIGIDITY IN RABBITS

No. of Rabbit	Right Eye		Left Eye	
	5.5-gm. Weight	10.0-gm. Weight	5.5-gm. Weight	10.0-gm. Weight
61	29 ± 4	27 ± 4	27 ± 3	27 ± 2.5
196	24 ± 3	25 ± 5	23 ± 2	24 ± 4.0
225	24 ± 3	23 ± 4	22 ± 3.5	23 ± 4.5
242	26 ± 3	26 ± 4.5	26 ± 4.5	25 ± 3.0
243	24 ± 3	27 ± 3.5	23 ± 3	26 ± 2.5
255	27 ± 5	23 ± 5	23 ± 3.5	21 ± 3.5
291	30 ± 5	34 ± 6	26 ± 2.5	30 ± 3.0
293	27 ± 4	28 ± 4	26 ± 2.5	27 ± 2.5
315	20 ± 3	20 ± 4	18 ± 1	16 ± 2.0
316	19 ± 1	20 ± 2.5	19 ± 1	20 ± 1.0
351	20 ± 5	24 ± 5	24 ± 2.5	20 ± 5.0
369	26 ± 4	29 ± 3	25 ± 3	29 ± 3.0
370	25 ± 4	27 ± 4	20 ± 2	24 ± 3.0
371	28 ± 4	30 ± 6	28 ± 4	31 ± 4.0
372	27 ± 4	27 ± 4.5	24 ± 3	27 ± 5.5
373	25 ± 4	27 ± 3	24 ± 2	26 ± 4
374	27 ± 4	26 ± 4	26 ± 4	27 ± 3
375	23 ± 4	23 ± 3	20 ± 1.5	23 ± 4
376	22 ± 4	22 ± 4.5	21 ± 4	22 ± 4
377	20 ± 4	17 ± 2	21 ± 4	18 ± 5

RESULTS

The ocular tension with the 5.5-gram weight varied in 20 rabbits between 18 and 30 mm. Hg. The standard deviation for each animal varied from 1 to 5. For

TABLE 2

EXAMPLES OF DAILY DETERMINATIONS EXPRESSED IN MM. HG OF TONOMETRIC OCULAR TENSION IN TWO RABBITS

Day	Rabbit No. 243				Rabbit No. 225			
	Right Eye		Left Eye		Right Eye		Left Eye	
	5.5-gm. Weight	10.0-gm. Weight	5.5-gm. Weight	10.0-gm. Weight	5.5-gm. Weight	10.0-gm. Weight	5.5-gm. Weight	10.0-gm. Weight
1	25	24	25	24	29	24	25	27
2	25	27	21	24	21	20	21	20
3	21	27	21	27	20	27	23	31
4	25	24	27	22	25	20	21	24
5	21	27	21	25	20	20	27	24
6	20	25	23	27	29	20	25	18
7	21	22	18	24	21	20	25	20
8	23	24	21	24	25	29	21	27
9	29	36	29	26	25	25	25	24
10	23	27	23	27	25	27	18	19
11	25	31	25	29	23	20	18	19
12	29	31	27	31	25	20	18	20

TABLE 3
EFFECTS OF VARIOUS DRUGS ON OCULAR TENSION IN MM. HG AND RIGIDITY OF RIGHT EYE OF RABBITS

No. of Rab- bit	Paredrine 1%				Pilocarpine 1%				Atropine 1%			
	5.5-gm. Weight		10.0-gm. Weight		5.5-gm. Weight		10.0-gm. Weight		5.5-gm. Weight		10.0-gm. Weight	
	30 min.	4 hrs.	30 min.	4 hrs.	30 min.	4 hr.	30 min.	4 hrs.	30 min.	4 hrs.	30 min.	4 hrs.
61	32±3.5	27±5.5	35±4.0	31±6.0	33±2.5	31±2.2	33±6.0	33±5.5	33±4.0	32±4.0	35±	29±6.0
196	24±2.5	22±4.5	27±3.0	21±3.5	24±2.5	23±1.5	25±5.0	26±2.5	28±6.0	24±4.0	22±	25±2.5
225	24±3.5	20±2.0	24±3.5	20±2.0	25±2.0	21±1.5	22±4.0	22±2.5	26±5.0	26±6.0	25±	22±2.5
242	30±2.0	24±4.0	31±5.6	26±5.0	29±3.0	26±4.0	34±5.0	28±3.5	27±2.5	26±3.5	32±	26±7.5
243	29±5.0	24±5.0	28±5.0	27±5.0	29±3.0	26±2.0	32±4.0	27±4.0	29±3.0	29±2.5	27±	28±2.5
255	30±2.5	24±3.0	30±4.0	28±2.5	24±5.5	27±4.0	25±5.0	29±7.5	26±7.5	27±3.5	22±	26±4.0
291	36±4.0	30±2.0	38±4.5	31±4.0	34±6.0	35±3.0	39±5.0	34±5.5	33±3.5	32±3.0	34±	39±7.5
293	32±3.0	31±3.5	35±5.0	32±2.0	32±8.0	36±4.0	30±5.5	34±4.5	31±7.0	29±3.5	29±	28±5.0
315					23±2.0	18±0.0	22±6.0	22±1.0	24±2.5	23±2.5	23±	20±1.5
316					23±3.0	21±4.0	21±4.5	24±6.0	27±4.5	27±4.0	23±	24±5.5

the 10-gram weight, the tension was from 20 to 34 mm. with a standard deviation of 2.5 to 6 (table 1). There was no essential difference in the tensions between morning and afternoon determinations. It was noted that the more excitable rabbits were prone to greater variations in tension. There were no significant differences in the results for the two different weights (table 2).

Instillation of 3 drops of 1-percent paredrine in the eyes of eight animals showed an ocular tension varying from 24 to 36 mm. with the 5.5-gram weight and 24 to 38 mm. with the 10-gram weight. Although the average readings appear higher than without paredrine, the majority of animals showed no significant changes either in tension or in rigidity. Introduction of pilocarpine and atropine was equally without appreciable changes (table 3).

Oral administration of isotonic, hypotonic, and hypertonic solutions showed significant changes. Following the use of hypotonic solutions, there was an increase in tension in 10 to 15 minutes. The rigidity remained unchanged. The difference in tension from the normal values varied from 6 to 14 mm. Hg. Isotonic solutions induced no significant changes. Administration of hypertonic solution resulted in a decrease of tension but without change in rigidity. The decrease occurred within 15 minutes and was less than normal by 6 to 10 mm. Hg (table 4).

DISCUSSION

The choice of method of estimating ocular tension in experimental animals depends on the purpose of the investigation. The manometric procedure produces variable degrees of trauma which may influence the experiment, and the number of determinations is necessarily limited. The advantage lies in obtaining absolute values. The tonometric method, on the

TABLE 4

OCULAR TENSION OF THE LEFT EYE BEFORE AND AFTER ORAL ADMINISTRATION OF ISOTONIC, HYPOTONIC, AND HYPERTONIC SOLUTIONS

No. of Rabbit	Distilled Water				.9% NaCl				4% NaCl			
	5.5-gm. Weight		10.0-gm. Weight		5.5-gm. Weight		10.0-gm. Weight		5.5-gm. Weight		10.0-gm. Weight	
	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
315	19	33	20	31	19	21	24	20	18	10	20	8
316	19	29	18	27	21	21	20	24	19	11	19	15
369	25	31	29	39	25	27	31	33	21	15	22	11
373	20	27	23	31	21	23	24	24	20	11	20	13
375	21	33	24	36	20	21	21	24	19	9	19	9

other hand, allows repeated determinations without inflicting injury. It must be emphasized that the method measures the impressibility of the wall of the eye from which tension is deduced. If comparative values are desired to determine experimental changes, the tonometric procedure is adequate. However, the standard deviation should be ascertained to avoid ascribing undue significance to all variations. To obtain comparative values, a sufficiently large number of determinations must be made, the averages determined, and standard deviations calculated.

Gruenhagen's¹ manometric determinations of the rabbit's ocular tension varied between 25 to 26.5 mm. Hg. The range of tonometric readings in our experiment was from 20 to 30 mm. These readings also agree with results obtained in man.^{2, 3, 4} In the normal human eye, there

is a diurnal variation,^{5, 6} frequently of 5 to 6 mm. Hg. The tension is greatest in the morning and falls gradually during the day. It begins to rise again at night. It was noted that the difference in the morning and afternoon tension in the rabbit was not significant.

In evaluating the findings in these experiments, the results of Friedenwald's tonometric studies⁷ were employed. Two different weights were used. When similar readings were obtained with the two weights, the rigidity was considered normal. Friedenwald's definition of the term, rigidity, is the resistance which the eye exerts to distending forces.

The action of atropine and eserine on ocular tension has been ascertained by other investigators.⁸ Their results indicated that by the use of manometric methods there were no significant changes. Slight deviations found by other workers⁹

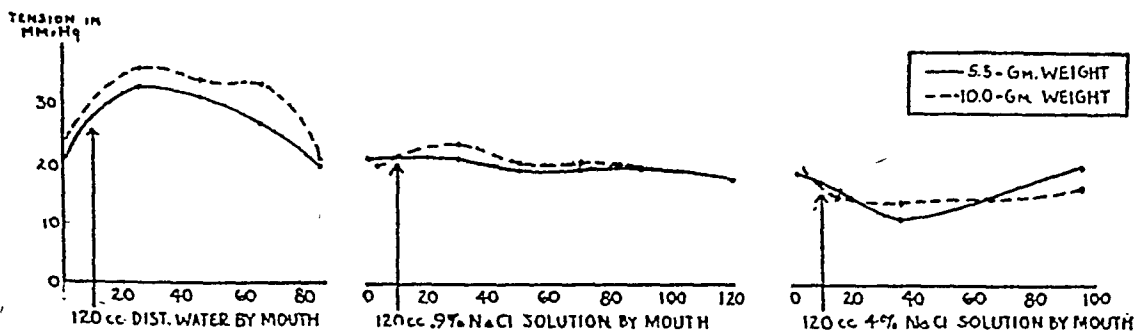


Chart 1 (Schmerl and Steinberg). Examples of changes in ocular tension of the left eye of a rabbit before and after oral administration of isotonic, hypotonic, and hypertonic solutions.

may be accounted for by conditions in the experimental procedures, such as partly filled anterior chambers.

Drinking of water tends to raise the ocular tension, and the Marx test is an application of the phenomenon. Studies utilizing the "drinking test" indicated that relatively small volumes of water are capable of increasing the tension in the normal eye¹⁰ and the more so in the glaucomatous.¹¹ On the basis of such experiments, it was postulated that osmotic pressure does not play a part in the elevation of the ocular tension. It was also pointed out^{12, 13} that after introduction of hypertonic salt solution, the blood volume tends to return to normal within 30 minutes, whereas the ocular tension remains decreased for several hours. The physicochemical reactions involved in this process are not clearly understood.

In the experiments reported here, it is apparent that a certain relationship exists between salt concentration and ocular tension. With ingestion of hypotonic solutions, the tension is increased; with hypertonic, it is decreased; and with isotonic, there are no significant changes.

SUMMARY

Tonometric determinations of the impressibility of the wall of eyes were made in a number of rabbits over a prolonged period. The tension and the rigidity were then deduced. Determinations were made at different periods of the day, after instillation of paredrine, atropine, and pilocarpine, and after ingestion of isotonic, hypotonic, and hypertonic salt solutions. Average values, standard deviations, and significant differences were determined.

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THE AUTONOMIC NERVOUS SYSTEM IN OCULAR DISEASES*

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It is the purpose of this thesis to present certain clinically studied ocular disturbances both functional and organic, which have as their common etiology dysfunction of the autonomic nervous system.

Recent knowledge of the role played by the autonomic nervous system in the functioning of the body has opened new vistas. The mechanisms are known by which pain, cold, emotional states, and other conditions that excite autonomic discharges can induce or participate in pathologic processes. Morbid phenomena which have long been inexplicable are thereby reasonably explained.

The borderline between normal and abnormal physiology and between functional and organic diseases is nowhere so thin as in the effects produced by dysfunction of the autonomic nervous system.

Those champions of the modern concept "Psycho-somatic medicine," such as Dunbar,^{1, 2} and Weiss and English,³ have found their best and most readily provable arguments in the study of the organic pathology resulting from autonomic imbalance. Actual structural change in the cells consistent with organic disease processes will be seen to follow prolonged physiologic upsets.

Subjective symptoms of functional origin are found giving rise to the objective signs of disease.

There are, perhaps, few places in the body so well adapted to the clinical study

of such phenomena as the eye, much of whose normal physiology is under autonomic control.

ANATOMY

In the history of the investigation of the vegetative nervous system, anatomic knowledge developed far ahead of physiologic experiment.

Relatively little still is known of the central connections of the sympathetic-nervous-system fibers in the brain. On the basis of clinical and experimental studies, however, it is conjectured that such centers probably exist in the cerebrum, the hypothalamus, the medulla, and the cord (Beattie *et al.*,⁴ 1930).

Evidence of cerebral control (especially the frontal lobes) over the sympathetic fibers of the eye is slight, but stimulation of a center immediately lateral to the infundibulum in the hypothalamic region brings about a pupillary dilatation, separation of the lids, and retraction of the nictitating membrane (Beattie,⁵ 1935). This effect persists after section of nerves II, III, and V, but is stopped by destruction of the sympathetic. The general vasomotor centers are situated in the medulla. An "inferior ciliospinal center" for sympathetic control of the eye undoubtedly exists in the upper part of the cord between the levels of VI C and IV T.

Arising in the intermedio-lateral tract of the gray matter of the ciliospinal center, the preganglionic sympathetic fibers leave the central nervous system by the ventral roots of the thoracic nerves I, II, and III, with the larger number of fibers to the eye in the first thoracic root. The white rami communicantes continue the

* From the Department of Surgery, Division of Ophthalmology, University of California Medical School. Presented as a candidate's thesis for membership in the American Ophthalmological Society, November, 1945.

course of these fibers up the cervical-sympathetic chain, through the inferior and middle cervical ganglion to their termination in the superior cervical ganglion.

The majority of the nonmedulated, postganglionic fibers leave the superior cervical ganglion as the nervous caroticus internus, which accompanies the carotid artery through the carotid canal into the skull, where it breaks up into a fine plexus adherent to the vessel wall. This is divided into the internal carotid plexus and the cavernous plexus.

From the cavernous plexus, branches are given off to the third nerve, to the fourth nerve, to the Gasserian ganglion, and the first division of the fifth nerve, and thence to the eye by way of the long ciliary nerves, to the ciliary ganglion, and thence to the eye as vasomotor fibers via the short ciliary nerves.

From the carotid plexus branches are given off to the sixth nerve, to the branches of the ophthalmic artery, and to the periorbita, the muscle of Müller, and possibly the lacrimal gland.

The parasympathetic nervous system of the eye is found in association with the third nerve, in which are found the pupillo-constrictor fibers to the iris and the nerves to the ciliary muscle, relayed to their end stations by way of the short ciliary nerves (Duke-Elder⁶).

For a comprehensive review of the autonomic innervation of the eye, reference is made to Kuntz⁷ and White and Smithwick.⁸

PHYSIOLOGY

For our purposes, a consideration of the physiology of the autonomic nervous system will be limited to a brief review of its ocular relationships with particular emphasis on vasomotor control in the eye.

A great part of the work which has led

to our present understanding of the physiology of the sympathetic nervous system has been carried out by Cannon⁹ and summed up in his book, "The Wisdom of the Body." He particularly emphasized the essential character of the system in conditions of stress and strain. This applies to the eye no less than it does to other parts of the body. Some of the more common conditions which arouse its activity are pain, extremes of temperature, lack of oxygen, infection, and intense emotional or psychic trauma. He has stated that this mechanism may actually be harmful unless the emotion is transformed into action. "If no action succeeds the excitement and the emotional stress (even worry or anxiety) persists, then the bodily changes due to the stress may be profoundly upsetting to the organism as a whole" (Cannon,¹⁰ 1933). This same point has been expressed by Fulton¹¹ in the statement that "the heart and circulation may be worked just as hard from an armchair as from a rower's seat."

Just as anatomic investigation has demonstrated the importance of the hypothalamic region in the autonomic nervous system, so physiologic experimentation has shown that the hypothalamus, in addition to carrying out the autonomic expression of emotion, serves as a regulator of body temperature, through vasomotor control, and the whole delicate involuntary adjustment to the external environment. Alvarez¹² has presented convincing evidence that the hypothalamus can be upset by fatigue, lack of sleep, and nervous strain, and that, in many persons, it behaves erratically because of poor nervous inheritance.

Of all functions of the autonomic nervous system, that of the vasoconstrictor action of the sympathetic is of most interest to the ophthalmologist. In addition to distributing vasoconstrictor fibers to

the entire surface of the body, the sympathetic system constricts the cerebral and retinal arterioles (Penfield,¹³ 1932).

While the most active vasoconstrictor action supposedly takes place in the arterioles, a definite nervous control of the capillaries and veins has also been demonstrated. Cessation of blood flow through a capillary loop results from constriction of the Rouget cells and swelling of the endothelial-cell nuclei and follows a stimulus with too short a latent period to be anything but nervous action. Nervous control of the veins has also been demonstrated, and there is good reason to believe that the engorgement of the veins after sympathectomy is due to their release from the vasoconstrictor center.

Because the control of the entire circulation is essentially directed to regulate the blood supply to the capillaries, they are the vital part of the circulation. This is especially true of the eye and most particularly true of the macular area of the retina, whose metabolic interchange is wholly through the underlying choriocapillaris.

The contractility of the arterioles, capillaries, and venules of the eye, as elsewhere in the body, is controlled by two mechanisms, a nervous and a chemical, by the reciprocal action of which the small vessels are constantly kept in a state of tonicity. Reference has been made to the physiology of nervous control. Chemical control is maintained more directly by local conditions and forms a fine adjustment of great precision, though there is a close interrelation between the two.

The chemical control of the circulation is carried out by two groups of substances: the first, hormonal and acting as constrictors and typified by pituitrin and adrenalin; and the second, produced locally by the tissue cells and typified in histamine. The complete reaction pro-

duced by these histamine-like substances is a "triple response," consisting of a primary and local dilatation of the minute vessels, a local increase in capillary permeability, and a widespread dilatation of neighboring arterioles. The occurrence of this reaction in the vascular system of the inner eye will be shown to be of considerable importance. Recent experiments by Shorr *et al.*¹⁴ have demonstrated the production by the kidney of a vaso-excitor material, probably identical with the renin-angiotonin system in its action on the terminal vascular bed, and an opposite-acting, vaso-depressor material produced by the liver and skeletal muscle whose genesis is anoxia in tissues.

METHOD OF STUDY

The various clinical methods of study of vasomotor pathways and reactions have been well described by White and Smithwick⁸ and Kuntz.⁷ Reference is made primarily to peripheral vascular disturbances in the extremities, but the methods used are equally applicable to the study of ocular vasomotor disturbances. These methods have been augmented by observation on certain objective and subjective ocular signs and symptoms indicative of autonomic imbalance and their relationship to the clinical entity of "vasoneurotic diathesis" described by Horniker¹⁵ and by Gifford and Marquardt.¹⁶

Due to lack of facilities, complete studies were carried out on relatively few of the cases presented in this paper. However, it became possible through observation of these cases to recognize a symptom complex in the others, which, when associated with certain typical signs of vasomotor instability, was sufficiently characteristic almost to preclude the necessity of pressor tests, skin-temperature readings, capillary microscopy, diagnostic procaine block, and foreign protein test.

THE AUTONOMICALLY UNSTABLE PERSON

The complete picture of the "typical" autonomically unstable individual, as seen in great numbers in the military forces of the United States, is as follows: An asthenic young man, about 22 years of age, rather nervous and ill at ease during questioning and examination, with from 9 to 18 months' training and about 7 months of overseas duty or at some rather isolated mainland post. He complains of frequent or constant headache, usually unilateral and frequently retrobulbar in location. He often has transient dizziness or syncope associated with blurring of vision which may last from a few seconds to 10 minutes. The visual disturbance varies from a slight "film" to complete "blackout." The patient states that he has lost some weight, often as much as 20 pounds; that he has always been "nervous" but that in recent months he has become more so and he has had insomnia. He sometimes volunteers the information that he thinks this nervousness is due to "too much smoking" or vice versa, that he is smoking much more lately because of his nervousness. In any case, he has often doubled his cigarette consumption. If he has been in active combat, he readily admits to being very anxious and emotionally upset immediately preceding, sometimes during, and after action. If he is married, which is usually the case, he confesses anxieties about his wife, his children, his farm crops, or his domestic problems in general. Nostalgia is a frequent complaint.

When questioned about his family, there is frequently a history of an ailing mother with "sick headaches." There is usually a fairly stable family background with little abnormal parental behavior.

Physical examinations (aside from the various ocular signs to be described later) shows a rather tall, thin, under

weight young man. Hands and feet are moist to actually wet with perspiration regardless of the climatic conditions prevailing at the moment of examination. (Some men were examined in the northwestern United States in winter and others in the tropics with high temperatures and humidity.) The fingers and toes are cold to touch. The finger tips become quickly more cyanotic than normal, when held hanging at the sides, and very pale when elevated for a few minutes above the head. The pupils are dilated in an ordinarily light room but respond readily to light and accommodation. The blood pressure is an average 120/70 and is affected very little if at all by pressor test. The pulse is inclined to be more rapid than normal in a resting person. General physical examination, including a thorough search for any possible foci of infection, is negative except for the occasional finding of a granuloma at the apex of a devitalized tooth and occasional hypertrophied tonsils.

There is a fine tremor of the extended hands, at times very marked. Psychiatric evaluation, which was obtained in a fairly large number of cases, revealed tendencies toward, or frank and outspoken anxiety neurosis. Several soldiers showed many of the signs and symptoms of "combat fatigue," and in a few instances, the autonomic instability was so marked as to make the diagnosis of true "combat fatigue" open to question.

The military duty to which these men were subjected varied tremendously. Some had had most difficult and prolonged combat duty with days and weeks of exposure to battle conditions. They had lived in muddy fox holes in temperatures well over 100°F., with humidity of 80 to 90 percent. Food had been mostly C and K rations. Sleep was fitful because of constant alerts. They had endured in-

cessant bombing and heavy shell fire and, although they had suffered no physical injury of any consequence, had been subjected to intense psychic trauma. Others had had prolonged periods of

time. There were numerous instances in which the only rigors of military duty were those found in "boot camp" or indoctrination schools and training centers. For the most part, these men were very young,

TABLE 1
CENTRAL ANGIOSPASTIC RETINOPATHY—SYMPTOMS

Case No.	Head-ache	Corrected Vision		Scotoma 2/2,000	Metamorphopsia	Variation in Vision	Sensitivity to Cold	Cyanosis of Hands	Pallor of Hands	Hyperhydrosis	Cold Hands	Nervousness	Cigarettes per Day
		O.D.	O.S.										
1	Left Frontal	20/20	20/200	1°	no test	2+	1+	1+	1+	2+	2+	1+	20
2	Bilateral Orbital	20/50	20/50	no test	no test	3+	2+	2+	2+	3+	2+	1+	15
3	Orbital	20/20	20/30	1°	no test	2+	1+	2+	2+	3+	2+	2+	20
4	Frontal	20/50	20/50	1°	2+	3+	1+	1+	1+	2+	2+	1+	10
5	Orbital	20/25	20/25	1°	2+	4+	—	1+	1+	2+	1+	—	15
6	None	20/40	20/20	1°	2+	—	1+	1+	1+	2+	—	—	15
7	Orbital	20/40	20/20	2°	3+	—	—	no test	no test	1+	1+	—	10
8	Frontal	20/30	20/30	no test	no test	3+	1+	2+	2+	3+	2+	2+	0
9	Orbital	20/30	20/40	1°	1+	2+	—	1+	1+	2+	2+	2+	10
10	None	20/80	20/20	2°	no test	—	—	no test	no test	1+	1+	—	20
11	Orbital	20/100	20/20	3°	2+	—	1+	2+	2+	2+	2+	—	10
12	Orbital	20/30	20/20	1°	2+	3+	2+	—	—	3+	2+	3+	40
13	Frontal	20/30	20/30	no test	no test	3+	1+	1+	1+	2+	1+	2+	20
14	None	20/40	20/20	5°	no test	—	—	no test	no test	3+	2+	—	0
15	Orbital	20/20	20/20	none	none	3+	—	no test	no test	3+	1+	3+	30
16	Frontal	20/20	20/20	none	none	2+	—	no test	no test	1+	1+	1+	10
17	Orbital	4/200	20/20	25°	no test	—	—	1+	1+	2+	1+	2+	20
18	Orbital	20/20	20/80	1°	2+	3+	1+	2+	2+	4+	2+	2+	30
19	Frontal	12/200	20/20	2°	no test	2+	—	1+	1+	2+	2+	3+	30
20	None	20/20	20/70	3°	3+	2+	—	1+	1+	2+	2+	—	10
21	Frontal	20/30	20/30	1°	no test	4+	1+	0	0	3+	2+	3+	25
22	Right Orbital	20/60	20/20	1°	2+	3+	3+	2+	2+	2+	3+	2+	30
23	Right Orbital	20/200	20/50	3° O.D. 1° O.S.	no test	0+	1+	3+	3+	4+	3+	4+	0
24	Orbital	20/40	20/40	1°	no test	2+	0	2+	2+	3+	3+	3+	0
25	Frontal	20/200	20/20	3°	2+	3+	0	2+	3+	4+	2+	4+	40
26	Orbital	20/30	20/20	1°	1+	2+	0	2+	3+	3+	3+	1+	20
27	Left Orbital	20/20	20/30	1°	2+	2+	1+	3+	3+	4+	3+	2+	10
28	None	20/25	20/25	0	2+	3+	0	2+	3+	3+	2+	1+	20
29	Frontal	20/40	20/20	1°	2+	2+	2+	2+	3+	4+	2+	2+	0
30	Orbital	20/40	20/20	2°	no test	2+	0	3+	3+	4+	3+	2+	30
31	Orbital	20/50	20/40	2°	2+	1+	1+	3+	2+	3+	3+	2+	0
32	Orbital	20/70	20/30	2° O.D. 1° O.S.	1+	2+	1+	2+	3+	3+	3+	2+	20
33	Frontal	20/40	20/40	1°	2+	2+	0	1+	1+	3+	2+	1+	20
34	None	20/30	20/25	0	1+	2+	3+	2+	4+	3+	4+	1+	15
35	Right Orbital	20/100	20/20	2°	2+	1+	3+	1+	2+	2+	3+	2+	40
36	Right Orbital	20/200	20/20	5°	2+	3+	3+	3+	3+	4+	4+	3+	60
37	Frontal	20/40	20/40	no test	no test	2+	2+	1+	2+	3+	3+	1+	20
38	Frontal	20/70	20/40	5°	1+	2+	2+	2+	2+	3+	3+	2+	15
39	Orbital	20/30	20/30	1°	2+	3+	0	2+	2+	3+	3+	3+	0
40	Orbital	20/30	20/20	1°	0	2+	0	2+	3+	4+	3+	0	25

duty in isolated outposts such as the Aleutian Islands, where their chief enemy was lack of activity and exquisite boredom. They were repeatedly exposed to subzero weather and, in several instances, suffered greatly from it. Some had suffered from intense glare of the tropic sun on water and attributed their ocular disturbances to this glare, whereas others, including several submariners, were denied the sight of the sun for weeks at a

were frankly, miserably homesick. Their psychiatric examinations showed almost uniform tendencies toward true anxiety neuroses.

It will be seen from analysis of the foregoing data that all of these patients had two things in common: They demonstrated the clinical picture of vasoneurotic diathesis, and they were all subjected to one or more known autonomic nervous-system stimulants; namely, emotional or

psychic trauma, exposure to extremes of temperature, the vasospastic action of cigarettes, occasional infection, pain, dehydration and hypoglycemia induced by prolonged periods of strenuous muscular exertion, and fatigue approaching exhaustion.

Certain other cases will be discussed in which it was felt that the ocular disturbances were the result of direct trauma to the eye, as in contusion or exposure to infrared or heat rays, both of which are known to give rise to histamine production with the resulting "triple response" in the tissues involved.

OCULAR MANIFESTATIONS

The ocular manifestations of autonomic-nervous-system dysfunction to be considered are as follows: (1) central angiospastic retinopathy; (2) ocular changes in Raynaud's disease; (3) amaurosis fugax; and (4) commotio retinae.

CENTRAL ANGIOSPASTIC RETINOPATHY

This is the term applied by Gifford and Marquardt¹⁶ to a type of macular retinal lesion which they felt to be definitely of circulatory origin and of sufficient importance to be considered a clinical entity.

It is my opinion that their conclusions and the name were well supported by their case reports. My own case reports will be seen to confirm their findings in many respects. As pointed out in their article, the identical clinical picture has been described at intervals in the literature under the names: recurrent central retinitis; retinitis centralis; central serous retinopathy; preretinal edema; idiopathic flat detachment of the retina; retinitis centralis annularis; central angiospastic retinitis; angiosclerotic and angiospastic retinoses; juvenile exudative macular retinitis; and choroiditis centralis serosa.

In the majority of reports, small groups of cases were seen and, for the most part, the investigators considered the condition of inflammatory origin. A notable exception to this was the suggestion of Kraupa¹⁷ that the lesions could be attributed to retinal ischemia resulting from capillary changes. It remained for Horniker,¹⁵ and later for Bailliart,¹⁸ and Gifford and Marquardt¹⁶ to establish evidence of vasomotor instability in these cases and to demonstrate the vasospastic etiology of the retinal lesion.

Shortly after the entrance of the United States into World War II, medical officers in the United States Navy began to see cases of binocular or monocular macular lesions in young people, in numbers out of all proportion to those seen in civilian practice in the same age group. The cases appeared with such regularity, and so many widely scattered officers commented upon them, that a study of the condition was requested by the National Research Council, Subcommittee of Ophthalmology, and was undertaken by Dr. F. C. Cordes.¹⁹

His preliminary report was based upon data furnished by 11 Naval medical officers stationed in Pacific Naval hospitals, supplemented by personal observations of a few cases. Data on approximately 16 cases for this report were submitted by me, and I was in frequent communication with Cordes during its preparation.

From a close study of my own cases and of the description of the cases submitted by the other medical officers and by Cordes, it is obvious that all were concerned with the same clinical entity. Furthermore, these cases fit perfectly the description which Horniker, and Gifford and Marquardt give of the lesion which they call "central angiospastic retinopathy," and which Duke-Elder²⁰ calls

TABLE 2
CENTRAL ANGIOSPASTIC RETINOPATHY—OPHTHALMOSCOPIC EXAMINATION

Case	Eye	Edema	Pigment Change	Foveal Reflex	Hole in Macula
1	O.S.	Early gray edema, macular halo	Granular pigment, late	Absent	Small, oval, deep
2	O.U.	Macula hazy, halo	Coarse granular	Absent	None
3	O.S.	Dull gray, faint	None	Absent	None
4	O.U.	Entire macula elevated	Fine pigmentation	Absent	None
5	O.U.	Marked gray edema	None	Absent	None
6	O.D.	Gray edema, bright halo	Granular pigment	Absent	Minute hole
7	O.D.	Very slight	Heavy granular	Absent	Small, deep, red
8	O.U.	Both maculas blurred	Coarse granular	Absent	None
9	O.U.	Perimacular edema, halo	Fine pigment, yellow dots	Absent	None
10	O.U.	None	Fine pigment	Absent	Small, sharp, red
11	O.D.	None	Fine pigment	Absent	Small, sharp edges
12	O.U.	Gray elevation, halo	Coarse mottling	Absent	None
13	O.U.	Marked gray edema	Fine granular	Absent	Small, red, sharp
14	O.D.	Blurred gray macula	Suggestion, fine white dots	Absent	None
15	O.U.	None	Faint, pigment change	Absent	None
16	O.D.	None	Coarse granular, marked	Absent	Sharp, small, red
17	O.U.	Marked, bright halo	Coarse granular	Absent	None
18	O.S.	Slight, early	Fine granular	Absent	Hole $\frac{1}{4}$ disc diameter
19	O.U.	None	Coarse, 5-6 yellow dots	Present	None
20	O.S.	None	Faint, fine pigment	Present	Minute, vertical oval
21	O.D.	Early edema, ring reflex	Granular with yellow dots	Absent	None
22	O.D.	Slight	Fine granular	Absent	Minute red hole
23	O.D.	Early slight edema	Coarse, mottled	Absent	Small, dark red hole
24	O.U.	Blurred, gray maculae	Fine, numerous yellow dots	Absent	None
25	O.D.	Slight grayness	Coarse, granular	Absent	Minute red, oval hole
26	O.D.	None	Fine	Absent	Minute red hole
27	O.S.	None	Slight	Absent	Minute, sharp hole
28	O.U.	Gray elevation macula	Fine	Absent	Small, sharp edges
29	O.D.	None	Heavy, coarse	Absent	Dark, sharp edges
30	O.D.	Slight	Coarse, granular	Absent	Small, oval, red
31	O.U.	Marked in early stages	Heavy, with yellow dots	Absent	Small mound with crater
32	O.U.	None	Faint	Absent	Small, sharp, round
33	O.U.	Marked in early stages	Early, moderate	Absent	Extremely small
34	O.U.	Slight	Coarse, granular	Absent	Irregular, small, right
35	O.D.	Gray, bright halo reflex	Fine, many yellow dots	Absent	Minute, oval, red
36	O.U.	Marked in early stages	Pear shaped, heavy	Absent	Mound with crater
37	O.U.	None	Moderate, some white dots	Absent	Round, sharp, red
38	O.D.	Slight	Many yellow dots	Absent	Small, crater like
39	O.U.	Slight	Coarse, many yellow dots	Absent	None
40	O.U.	Gray, small in area	Coarse, marked	Absent	Very small

"central serous retinopathy" in his textbook discussion of macular capillary disturbance.

For purposes of clarity and simplification, one case only will be reported in detail with results of examination of the peripheral vascular and autonomic nervous systems. The remaining 39 cases will be reported in tabular form. It is unfortunate that in this investigation facilities were not at hand with which accurate measurement could be made of skin-tem-

perature changes; but, in the majority of instances, the changes were so marked as to be readily measured with relatively crude methods and, as mentioned above, the clinical manifestations were so marked in many instances as almost to preclude the necessity of special vasomotor tests.

CASE REPORT

J. D. S., a corporal, U. S. Marine Corps Reserve, aged 22 years, entered

the hospital on November 29, 1944, with a diagnosis of amblyopia. His trouble began in early June, 1944, while aboard a ship approaching Saipan, preparatory to invasion. He first noticed a very severe, constant "boring" type of right-sided headache which centered mostly in the right orbit and was not relieved by sleep or aspirin. A short time later he noticed a blurring of vision which at first occurred in "waves" and would then clear. This rapidly became more constant until vision was very poor most of the time. He stated that he was extremely nervous but "no more frightened than the rest of the fellows—which was plenty." During the long sea voyage, he had increased his cigarette consumption from 15 to 45 or 50 a day—mostly "because of nervousness and nothing to do." He also noticed marked photophobia but considered this natural from the glare on the water.

During the amphibious attack on the island, he was in one of the first "waves" ashore and was subjected to vigorous shell and small-arms fire and some very near misses and sharp blast concussions. His head continued to ache but was much worse during any lull in his activity. In the course of the next week, he was under almost continuous and very severe nervous tension, with little sleep or rest. Vision became so blurred in his right eye that he began shooting from his left shoulder, although at times there was noticeable blurring of the vision of the left eye.

He volunteered the information that for the past seven or eight years he had "never been able to depend on his right eye, which frequently blurred out, especially when he was under nervous tension or when it was very cold." For this reason, he did not report to sick bay, believing that the disturbance was temporary as it had been before. His home was

in Wisconsin, and he had frequently noticed that he suffered more from the winter cold than most of his friends. He could not wear gloves because his hands "always got wet with sweat and then would freeze."

He carried on as best he could through the remainder of the invasion, reporting to the doctor because of his headache and poor vision only after his sector had been declared secure. Examination at that time showed vision to be 2/20 in the right eye, and a note was made in the health record that the "fundus details were indistinct and the retina seemed edematous." He was evacuated to a base hospital.

General physical examination showed a husky, well-developed young man who appeared well controlled and was very coöperative. There were no abnormalities in the system, and a thorough search for foci of infection including teeth, nose, and throat, and prostate were normal. X-ray studies of the chest were normal. Intradermal tuberculin test in 1:10,000 dilution was negative. Sedimentation rate was normal. Blood Kahn test was negative.

Patent clinical evidence of vasoneurotic diathesis was manifest as follows:

1. The pupils measured 8 mm. in diameter as compared with 2 and 3 mm. in two other enlisted men under the same lighting conditions.

2. The palms of the hands were grossly wet, so that, if a ruler edge were passed across them lightly, a pool of water collected in the center. This was in marked contrast with two normal control subjects.

3. Elevation of the hands above the head for three minutes produced a marked blanching of the fingers. When the hands were returned to shoulder level, they quickly showed a very blotchy appearance. This was noticed to a very mild degree in the controls.

4. With the hands hung dependent for three minutes, there was a noticeable cyanosis as compared with the controls.

5. The hands were cold to touch, especially the finger tips as compared to the controls'.

6. There was a considerable fine tremor of the extended hands.

7. The patient appeared calm but, when questioned about the tremor, stated that he always had it when he was "very nervous like I am now."

8. During the course of a rather short examination, the axillary perspiration soaked through and stained a large area of the shirt in marked contrast to the controls and the examiner in the same room.

Ocular examination. Vision in the right eye was 20/200 (2/20); left eye 20/20.

Visual field taken on the tangent screen at 2 M. with 2-mm. test object showed a 2° central scotoma, sharp in outline and dense, with the bulk of the defect extending below and nasal to fixation.

A test for metamorphopsia suggested by Comdr. Frank P. Smart²¹ was positive to a marked degree in the right eye and suggestive, although not definite, in the left eye. The test consisted of having the patient fixate steadily a cross placed on the middle line of a music staff of five lines. He then drew the lines as he saw them. The two outer lines of the staff appeared to be bent outward from the fixation point, indicating an inward traction of the nerve elements of the macular area. This type of metamorphopsia was a very constant finding in most of the cases tested.

External examination of the eyes including cornea, iris, and lens was negative. The vitreous was clear. The macular area of the right eye showed a pear-shaped, granular, and pigmented lesion, with sharp edges approximately the diameter of two retinal-vein trunks.

Around this the retina had a grayish tinge and showed a few faint radiating striations. There were five or six small yellowish dots in the area. The foveal reflex was absent. When the ophthalmoscope beam was cut down to a narrow slit, the central lesion appeared to be definitely depressed, and the surrounding retina slightly elevated, giving the appearance of a small crater at the top of a low mound. (A binocular ophthalmoscope was not available.)

The macula of the left eye showed an identical process except that it was of extremely slight degree and would have been missed entirely in a routine fundus examination. There was an irregular and eccentric foveal reflex and very little pigment change, but the central crater, although small, was definite, and was easily seen by red-free light.

Examination of the peripheral vascular system resulted in the following observations, in a draft-free room, at a temperature of 70°F. Skin temperatures were taken with a flat-bulb skin thermometer protected by a cork near its tip: (1) mouth temperature, 98.4°F.; (2) temperature of big toe, 83.2°F.; (3) temperature of middle finger, 87.2°F.; (4) temperature of big toe, three minutes after smoking one cigarette, 75°F.; (5) temperature of big toe after diagnostic procaine block of posterior tibial nerve behind the internal malleolus, right foot, 94.3°F.; (6) capillary microscopy of the bed of the nail showed a high degree of capillary narrowing.

A number of practically identical cases have recently been carefully studied both ophthalmologically and psychiatrically by Zeligs,²² who approached the problem psychosomatically and pointed out the occurrence of anxiety (induced by combat) as a common-type factor in the production of central angiospastic retinopathy.

RETINAL CHANGES IN RAYNAUD'S DISEASE

The following definition of Raynaud's disease was formulated by the peripheral vascular clinic of the Massachusetts General Hospital:

"Raynaud's disease is a form of peripheral vascular disturbance caused by tonic contraction of the smaller arteries in the extremities. During the early, uncomplicated states of the disease, there are no obvious pathologic changes in the walls of the arteries. The disease commonly involves symmetrical areas in the hands and feet, causing circulatory stasis with periods of cyanosis or pallid asphyxia. The severe cases go on to dry gangrene of the phalanges. The spasm is intermittent and occurs on exposure to cold or emotional stimuli; it involves only the terminal arteries while the main vessels continue their normal pulsations. Frequently these patients complain of excessive perspiration which is also limited to the extremities. The disease most commonly occurs in young individuals with hyperirritable nervous constitutions" (White and Smithwick⁸).

While the occurrence of the clinical entity described by Maurice Raynaud²³ is relatively uncommon, every student of peripheral vascular disturbances has encountered instances of acrocyanosis and all varieties and degrees of peripheral vasospasm. For practical purposes these may be assumed to be identical except in the intensity and duration of the spasm. Frequently these cases of mild vasospasm have been precipitated into typical Raynaud's disease. In true Raynaud's disease as well as in the borderline cases, hyperhidrosis is a prominent feature. This has also been seen to be a characteristic of the vasoneurotic diatheses almost universally associated with central angiospastic retinopathy.

Raynaud and others^{24, 25, 26} have described attacks of intermittent constriction

of the retinal vessels with blurring and even permanent loss of vision and Bailliart²⁷ has described a complete choroidal anemia with destructive retinal lesions. While it is true that a vasomotor neurosis would be expected to affect primarily the hands and feet, it is also true that the smaller arterioles (the site of the vasospasm) might well be affected in other parts of the body.

There is still some difference of opinion concerning the etiology of Raynaud's disease, but the greatest weight of evidence upholds Raynaud's original idea; namely, that at the onset of the disease the recurrent attacks of symmetrical vasospasm are due to an abnormal activity of the vasoconstrictor nerves.

I have had an unusual opportunity to study two cases of well-advanced Raynaud's disease in young men both of whom showed ocular disturbances. The cases were practically identical both in peripheral vascular involvement and in the eye examination. Skin-temperature readings were obtained in only one case, the report of which follows.

CASE REPORT

C. D. D., a 19-year-old yeoman, second class, was admitted to the hospital on the Dermatologic Service because of small, painful, dry ulcerations at the tips of the fingers and of several toes. He had first noticed pain and numbness of the hands, associated with extreme pallor of the fingers, when exposed to cold weather aboard a small ship in northern latitudes. While on this ship, he frequently was exposed to severe cold and active exercise and excitement in spite of his yeoman's rating, as each member of the crew was required to stand watches regardless of rate. He complained as little as possible for fear of being considered a shirker, but there were times when, under the combined stimulus of cold, exercise, and

excitement, the pain and discomfort were so intense as to cause him to weep. He particularly noted the prolonged, almost dead-white pallor of his fingers after these episodes. Several months before admission, he was transferred ashore, where he was assigned to work involving considerable typing. He was much more comfortable, but soon noticed that, after a

points, with symmetrical areas of dry gangrene and loss of substance at the tips, especially just under the nail edge. After three minutes' elevation of the hands to the level of the ears, they became extremely pale and began to give pain. On dependence of the hands to his sides, they quickly became very cyanotic. The same was true of the feet. The radial

TABLE 3

CENTRAL ANGIOSPASTIC RETINOPATHY—EXAMINATION OF THE PERIPHERAL VASCULAR SYSTEM

Case No.	Temp. of Toes Before Nerve Block	Temp. of Toes After Nerve Block	Mouth Temp.	Cigarette Reaction*	Capillar. Microscopy†
6	90.2°F.	95.4°F.	98.4°F.	8.4°F.	3+
12	82.4°F.	91.4°F.	98.6°F.	7.2°F.	2+
18	83.0°F.	90.2°F.	97.8°F.	9.0°F.	3+
21	88.6°F.	93.2°F.	98.6°F.	8.2°F.	2+
23	80.0°F.	88.8°F.	98.0°F.	6.4°F.	2+
25	80.2°F.	86.0°F.	98.2°F.	9.2°F.	4+
31	82.0°F.	90.0°F.	98.6°F.	7.2°F.	3+
35	86.4°F.	94.0°F.	99.0°F.	4.4°F.	3+
36	83.2°F.	Not taken	98.6°F.	8.2°F.	4+
39	84.0°F.	92.6°F.	98.4°F.	6.8°F.	3+

* Drop in temperature of big toe 3 minutes after finishing one cigarette.

† Spasm on basis of 1 to 4+.

Temperatures taken after 1 hour in a draft free room at 70°F.

few minutes of typing with his hands elevated to the typewriter keyboard at about the level of his nipples, the fingers became very pale and painful. He procured a high stool which lowered the level of his hands, and this helped for a while. During all this time, he had noticed that the small ulcerations on his finger tips failed to heal satisfactorily. His only ocular complaint was of periodic, somewhat disturbing blurring of his vision, especially in the right eye. These attacks would last for 5 to 15 minutes and were usually noticed when he was working under pressure to finish a piece of work in a specified time. He did not consider himself emotionally unstable nor nervous. He smoked 20 cigarettes a day.

Examination of his hands and feet showed typical symptoms of Raynaud's disease, including very wet, cold hands, and fingers that tapered almost to

and dorsalis pedis pulses were well palpated.

Ocular examination. Vision was: R.E., 20/30 blurred; L.E., 20/15. Refraction with cycloplegic showed a plus 0.75D. sphere for each eye, but without change in vision. Ophthalmoscopic examination was negative in the left eye, but the terminal branches of the superior temporal artery of the right eye showed definite and marked vasospasm and irregularity of caliber near the macula. The macula of the right eye showed a rather coarse granular pigmentation, with loss of foveal reflex and a generally "smeared" appearance. There was no loss of substance in the fovea. The appearance of the macula was identical with the late stages of a typical mild case of central angiospastic retinopathy.

Skin temperature readings on the right foot were as follows: (1) room tempera-

ture, 70°F.; (2) skin temperature, knee, 79°F.; (3) skin temperature, base of big toe, 70°F.; (4) skin temperature, base of big toe after one cigarette, 65°F.; (5) skin temperature, knee, after procaine nerve block, 82°F.

During the preparation of the patient for skin-temperature readings, there was noted marked increase in the sweating of the hands and feet and also such severe axillary sweating as to cause the patient embarrassment. After procaine nerve block, there was a prompt and spectacular decrease in the moistness of the treated foot.

AMAUROSIS FUGAX

Under this heading may be considered all those ocular disturbances that are transitory in nature, borderline in character, and that produce certain symptoms and signs due to autonomic instability, but leave no permanent, visible, organic change. These conditions may be listed as: (1) transitory visual loss under conditions of emotional stress; (2) visual disturbances under conditions of extreme fatigue, such as that seen in combat fatigue in the armed service.

Under the first of these headings may be placed the very numerous cases seen in young adolescents of somewhat unstable temperament, who manifest periodic "black out" under conditions of excitement, homesickness, worry, and the emotional shock of battle. Every medical officer in the Armed Forces has seen them in great numbers, and I have frequently seen them in civilian life in anxious medical students before or during an important examination. Within the past six months, I have so often encountered this symptom in patients with typical neuro-circulatory asthenia as to consider it of considerable importance as a diagnostic sign of that "disease." The patient is rarely sick enough to be hospitalized but

is seen in consultation in the out-patient clinic. His chief complaint is of frequent, periodic loss of vision in both eyes lasting upward of 30 seconds. The visual loss is described as a "fogging" of varying degree, sometimes culminating in complete "black out" as described by aviators at the termination of a dive, when the sudden change of direction of the plane forces the pilot downward so hard as to drain the blood from his cerebral vascular system (and possibly from the retina) into the extremities and splanchnic reservoirs. One outstanding case of this sort occurred in a fighter-plane pilot, who compared his periodic visual loss with that occurring in the "pull out" from a plane dive.

In all of these cases, there is definite, clinical evidence of hyperactivity of the sympathetic nervous system. Many of them show evidence of some degree of vasospasm, so that the tips of the fingers are cold and sometimes cyanotic. The most frequent and annoying associated symptom, however, is hyperhidrosis. These patients almost uniformly show a clammy wetness of the hands and feet which, under the mild psychic stress of questioning and examinations, becomes so marked that their hands drip beads of perspiration and everything they touch becomes wet. Also frequently noticed is a remarkable degree of axillary sweating, so that after a few minutes of questioning the patient is much embarrassed by large stains which appear on his shirt sleeves. There is no increase in generalized sweating, and comparisons of the patient's hands with those of medical corpsmen in the same room reveals a marked difference.

Careful ocular examination of these cases, including exhaustive muscle-balance tests, cycloplegic refraction, ophthalmoscopic examination, and visual-field tests revealed no objective findings of note.

Six men suffering from "combat fatigue" who complained of visual disturbance, have been seen in consultation with the neuropsychiatric departments. Of these, only one showed demonstrable organic change in the retina and some permanent visual disturbance. All six showed classical symptoms and history of

admitted that he frequently had been frightened and tense, and stated that this fear had increased in severity to such a degree that in the last few months of service every call to general quarters found him hyper-alert and trembling. Because of this nervousness, he had increased his cigarette consumption from

TABLE 4
CENTRAL ANGIOSPASTIC RETINOPATHY—TREATMENT

Case	Intravenous Typhoid dose in millions	Sodium Nitrite daily dose	Nicotinic Acid daily dose	Amino-phyllin daily dose	Case	Intravenous Typhoid dose in millions	Sodium Nitrite daily dose	Nicotinic Acid daily dose	Amino-phyllin daily dose
		mg.	mg.	gr.			mg.	mg.	gr.
1	5, 10, 25	100	—	—	21	10, 25, 25	100	—	—
2	5, 10, 25	100	—	—	22	10	100	150	7.5
3	—	100	—	—	23	5, 10, 25, 25	100	150	7.5
4	10, 20	—	—	—	24	—	—	—	—
5	—	—	—	—	25	10, 10	—	150	7.5
6	5, 10, 25, 25	100	100	7.5	26	—	—	150	7.5
7	—	—	—	—	27	25	—	150	7.5
8	—	100	—	—	28	—	—	—	—
9	—	—	—	—	29	10, 25	—	150	7.5
10	—	—	—	—	30	—	—	—	—
11	—	—	—	—	31	5, 10, 25, 25	—	150	7.5
12	10, 25	100	—	—	32	5, 10, 10, 10	—	150	—
13	—	—	—	—	33	5, 10, 10, 10	—	150	—
14	10, 25	100	—	—	34	—	—	—	—
15	—	—	—	—	35	5, 10, 10, 10	—	150	7.5
16	—	—	—	—	36	10, 10, 25	—	150	7.5
17	—	100	—	—	37	10, 15, 25	—	—	—
18	5, 10, 25	100	100	7.5	38	10, 15, 25	—	—	—
19	10	100	—	—	39	5, 10, 15, 25	—	150	7.5
20	—	—	—	—	40	—	—	—	—

combat fatigue, with the additional rather unusual history of frequent, transitory, visual loss lasting from a few seconds to over a minute.

CASE REPORT

W. H., seaman first class, aged 25 years, was admitted to the hospital on the neuropsychiatric service with the diagnosis of combat fatigue. He had been stationed aboard a ship which had participated in four major sea battles and which had been twice struck by bombs and once by shell fire from an enemy cruiser. He had never been particularly nervous in temperament, had a very stable background, and a good family history. He

15 to 80 cigarettes a day. He first noted a blurring of vision following a night battle. After the action had broken off and the "secure" signal was given, he returned to his quarters to find that objects were blurred and "misty." In about a minute, vision cleared. He attributed this phenomenon to exposure to gun flashes near by and to his staring into the dark for so long. Shortly after this, he began to experience rather frequent attacks of blurred vision which seemed to occur when he was tired or excited. He states that these attacks were not associated with reading or other use of his eyes. Two weeks before entry to the hospital, his ship was struck by an enemy bomb.

The explosion was at some distance from him and although he was knocked up against the bulkhead, he was not dazed or otherwise hurt, except that he felt like he was "going all to pieces." He began to tremble violently and completely lost his vision. He was found by a medical corpsman groping about the deck on his hands and knees and crying, and was taken to the sick bay. His vision gradually returned, and he believes that the total elapsed time of the visual loss was not more than 15 minutes. Since that time, however, he felt that his vision was not so good as before.

On admission to the hospital, he was found to be very nervous and apprehensive, with definite tremor of the hands and marked sweating of the palms. He frequently experienced severe nightmares from which he awoke crying. The least noise elicited a severe "startle reaction."

Examination of the eyes showed vision to be: R.E., 20/40; L.E., 20/25. Refraction with cycloplegic showed, R.E., a + 0.50D. cyl. ax. 90°; L.E. +0.25D. sph. Vision was not improved by correction of this error. The macula of the right eye showed the typical granular pigmentation with loss of the foveal reflex seen in central-angiospasm retinopathy. The macula of the left eye was normal in appearance.

It was felt that this case might well be placed in the classification of angiospastic retinopathy, except that the organic findings were so minimal and the visual loss was of a transitory character until the final attack.

Under rest and sedation and a minimum of psychotherapy, the patient's general symptoms cleared rapidly.

Of retinal angiospasm in general, Duke-Elder²⁰ points out that its recognition as a cause of amaurosis fugax is of relatively recent date. It can be produced experimentally by injection of adrenalin or

of the serum of hypertensive individuals, or, in susceptible persons, by cold, or by the inhalation of tobacco smoke. The actual observation of spasmodic contractions of the retinal vessels, of fleeting duration, associated with similar vascular phenomena elsewhere and leaving no trace, has established the condition as a clinical entity.

Cases of retinal angiospasm occurring in young individuals who show no signs of organic retinal arterial diseases are frequently associated with evidence of vasomotor instability elsewhere.

MIGRAINE

Although typical ophthalmic migraine is a cerebral rather than an ocular disturbance, it can scarcely be doubted that it is of vasomotor origin. As its chief manifestations are ophthalmic, it is included here.

The incidence of typical ophthalmic migraine (with homonymous scintillating scotomas and transient homonymous hemianopia, followed by headache, nausea, vomiting, and prolonged lassitude) is extremely high in the armed services.

This may be because we are dealing almost exclusively with the age group commonly subject to the disorder. It has been my experience, however, that careful questioning of many individuals reveals a definite background of long-standing, mild vasomotor instability that has been markedly aggravated by psychic trauma incident to duties in the Service.

A typical case will frequently include a family history of migrainous attacks in the mother, or sibling, or both. The past history reveals infrequent, but typical, migrainous attacks beginning as early as 8 to 10 years of age. Cautious questions will elicit the information that these attacks were usually precipitated by an unpleasant experience or in anticipation of some disagreeable situation. On entering

the Service; the attacks usually increase in frequency and severity during early adjustment in boot camp and then subside somewhat, only to break out anew with a change of duty—particularly in anticipation of foreign duty. In at least two instances in officer personnel, a series of violent and completely disabling attacks were precipitated by assignments to new commands entailing greatly increased responsibility. In three cases, I have precipitated attacks, in which I was able to map out congruous homonymous hemianopias, by announcing to the patients that I was discharging them from the hospital back to full-duty status.

A large percentage of the cases of typical ophthalmic migraine which I have examined have shown clinical evidence of generalized vasomotor instability, as judged by the criteria set forth, especially hyperhidrosis.

In only one case was I able to demonstrate an actual spasm of a retinal vessel during the prodromal attack of scintillating scotoma, although this has been frequently described in the literature. In no case have any permanent organic ocular or cerebral changes been noted.

It is recognized that cognizance must be taken of the other theories of the etiology of migraine, such as precipitation of attacks by food allergy, but in the vast majority of the cases examined by me, the etiologic factor was almost undoubtedly vasomotor, and the usual precipitating factor was psychic trauma.

COMMOTIO RETINAE

Under this classification will be considered the retinal changes incident to localized vasospasm resulting from: (1) ocular contusion; (2) blast concussion; (3) solar burns.

In a recent letter to the Navy Department, Bureau of Medicine and Surgery

News Letter, Prof. Alton Ochsner²⁸ stated:

As a result of trauma, vasoconstriction of peripheral arteries invariably occurs. This is undoubtedly a protective mechanism and is life-saving at times. The trauma initiating the vasospasm can be of any type: mechanical, accidental, operative, thermal or actinic. The greatest degree of vasospasm is seen apparently in crushing injuries and in frost bite.

The degree of vasospasm varies considerably in different individuals. Under some conditions and in some individuals, the degree of vasospasm may be so slight as to produce few, if any, manifestations. On the other hand, it may be so severe as to produce such ischemia that gangrene may develop. This condition has been designated as "local shock."

In addition to the actual necrosis and interference with wound healing which may result from the vasospasm associated with trauma, there may occur interferences with sensations, particularly sympathalgia, the so-called causalgia which previously has been difficult to explain. Many individuals with this condition were considered as malingerers, since the location of their pain did not correspond to the distribution of the peripheral nerves.

With vasoconstriction due to mechanical, thermal, or actinic trauma, there is a secondary dilatation of the minute vessels in the area, as previously stated in the discussion of chemical control of the circulation.

As has been pointed out, substances of the nature of histamine are produced locally by the tissue cells as the direct result of any trauma sufficient to liberate histamine from the cells. The complete reaction produced by these histaminelike substances is a primary and local dilatation of the minute vessels, a local increase in the permeability of the capillary walls, and a widespread dilatation of neighboring arterioles.

The reactive hyperemia that occurs after obstruction of the circulation is an example of this dilatatory action of local-tissue metabolites. Heat, light, or ultraviolet radiation dilates the capillaries through the same mechanism of histamine liberation.

In considering commotio retinae, under which we have classified the retinal changes associated with ocular contusion, blast compression or concussion, and solar retinitis, we are dealing with morphologic changes in the macula which are practically identical in each case.

Duke-Elder²⁰ has pointed out that one of the sites of election for retinal edema is the macula. In states of circulatory edema, this is probably due largely to the structure of the thick fiber-layers of Henle, which absorb large quantities of fluid, and to the avascularity of the central area. Such edema follows contusions to the globe and probably depends, as in the brain, upon a sudden vasoconstriction followed by an extreme vasodilation.

In commotio retinae from whatever cause (contusion, concussion, or thermal), the ophthalmoscopic picture is practically identical, varying only in degree. It is so remarkably similar to the clinical picture seen in central angiospastic retinopathy and also in the two cases of Raynaud's disease previously described as to defy ophthalmoscopic differentiation.

In its milder aspects, the edema produced is sometimes difficult to see. The retina in the macular area looks thicker and somewhat translucent; with a finely granular appearance and a series of radiating, somewhat spokelike reflexes. Occasionally, the entire macula will be surrounded by a bright "halo reflex," such as has been described in connection with angiospastic retinopathy.

This edema may persist for days to weeks but gradually subsides, leaving in its wake a definite and sometimes marked redistribution of pigment. In many instances, this is imperceptibly followed by autolysis of the retina in the foveal area, with production of the typical "hole" in the macula.

The only difference between this picture and the classical Berlin's opacity,

with its milky clouding of the retina, is one of degree.

It was a striking clinical feature of all three types of commotio retinae that the majority of the patients complained rather bitterly of a nagging, boring type of orbital pain which was very persistent and similar in every respect to the pain noted so frequently in the angiospastic cases. It is thought that this is probably a form of causalgia or sympathalgia.

CONTUSION RETINOPATHY

Case 1. L. W., aged 22 years, was struck in the right eye by a hand ball. There was immediate and marked loss of vision and pain in the eye. Examination that same afternoon showed an injected eye with traumatic dilatation of the pupil, edema of the lid, free cells in the aqueous, but no hemorrhage. Vision was finger counting at two feet. The macula of the right eye showed the grayish, translucent appearance of a moderately severe Berlin's opacity, with elevation of the retina in the macular area. During the next few days, the vision improved rapidly and the retinal edema subsided. The patient complained of severe pain deep in the orbit "behind the eye." As vision improved, the tangent-screen field showed a small central scotoma for the 2/2,000 isopter.

At the end of a week, vision was 20/70 in the right eye, and the retina had regained its normal transparency, although it still showed some edema and a definite granular pigmentation of the macula. The foveal reflex was absent.

Two months later, reexamination showed a typical small "punched-out hole" in the macula, and vision was 20/30. The pain in the orbit was still present, although decreasing in severity. A minute central scotoma was still demonstrable, and there was definite metamorphopsia, as tested by the "music-staff" test at 14 inches.

Case 2. C. B. P., a 20-year-old corporal of Marines, was injured on Iwo Jima. A bullet went through the right maxilla from below the right ear and "exploded" in his mouth. A large hole was torn in the palate and into the right antrum. There was moderate exophthalmos of the right eye. On examination, 10 days after injury, vision of the right eye was 20/30. The macula showed definite and fairly marked edema with granular pigmentation around the fovea and striate folding of the retina around the fovea. Reexamination, three weeks later, showed subsidence of most of the retinal edema but with marked increase in foveal pigmentation and no improvement in corrected vision. No scotoma could be demonstrated, but metamorphopsia was fairly marked.

Case 3. H. E. E., a 21-year-old private of Marines, was pushing a 37 mm. gun over rough terrain on Iwo Jima when the gun ran over a land mine. The gun was blown to bits. The patient was behind the steel shield and sustained some shrapnel wounds in his legs and lower trunk, and a few in his arms and face. He was unconscious for two days. When he regained consciousness, he could not see from either eye for another two days. Then vision in the right eye gradually returned. He believes he was struck in the face by a piece of the gun as the lids of both eyes and his nose were severely swollen and bruised.

Examination, 16 days after the injury, showed vision to be R.E., 20/40; L.E., light perception. The left eye showed a dislocation of the lens medially through rupture of the lateral zonule. The macula of this eye showed a very marked gray edema, with a dark-red spot in the fovea. Next to the disc was a small streak of traumatic choroiditis, or rupture of the choroid.

The right eye showed a coarse, granular pigmentation with a faint halo around the macula, as seen in minor degrees of edema. There was a very small scotoma for a 1-mm. object at 1 M., just at the upper edge of fixation. The clinical picture was identical with that seen in a subsiding angiospastic retinopathy. The patient had many of the signs and symptoms of combat fatigue, such as, startle reaction, tremor, nightmares, and anxiety. He also showed marked sweating of the hands and some coolness of the fingers. It was considered that the left eye showed definite evidence of contusion, with secondary angiospastic retinopathy. The findings in the right eye could be due to minor contusion, blast compression, or even severe psychic trauma. They serve to demonstrate the similarity in all three forms regardless of the etiology.

BLAST CONCUSSION

Case 1. H. L. M., a Marine Corps second lieutenant, aged 26 years, was injured by the blast from an exploding ammunition dump which went off about 100 yds. from him. He thought that seven or eight men near him were immediately killed by the blast. At the moment of the explosion, he was in a foxhole leaning down in an attempt to help his commanding officer, who had been injured by shell fire. Although he was blown from the hole, he was not struck by shell fragments and felt that the force of the blast was broken, thus saving his life. He was unconscious for six days and suffered some bleeding from ears and nose. Both ear drums were ruptured, but quickly healed. When he regained consciousness, he was almost completely deaf, and vision was little more than good light perception. Both hearing and vision rapidly improved, and in five days, vision was recorded as: R.E., 20/30; L.E., 20/40. On examination, three weeks after injury,

vision was: R.E., 20/25; L.E., 20/30; corrected to 20/25 (blurred) in each eye with a $-0.50D.$ cyl. ax. 90° . He had previously always had 20/20 vision, uncorrected, in each eye. Hearing was decreased in the right ear, 20 percent; in the left ear, 50 percent.

Both maculas showed granular pigmentation with some residual edema. The fovea of the left eye showed a minute, sharply outlined, red spot which looked like a small crater. No scotoma was demonstrated but metamorphopsia could easily be elicited in the left eye. The patient had shown some signs of combat fatigue including a severe tremor and very marked hyperhidrosis, but these had practically disappeared after three weeks, and he was anxious to return to duty.

Case 2. V. J. P., a 22-year-old seaman, first class, was blown 10 ft. or more across the deck of his ship by the explosion of a Japanese suicide dive bomber, containing a warhead which struck the ship. He thinks he was about 30 ft. from the plane when it struck. He was unconscious for several minutes, and there were several casualties near him. When he regained consciousness, he was blind but otherwise unhurt, except for some minor lacerations about the face and chest. He was disoriented, dazed, and almost completely blind for two days. Vision gradually improved in both eyes but remained blurred in the right eye. Examination, two weeks after the injury, showed vision to be: R.E., 20/40; L.E., 20/20. External examination of both eyes and X-ray pictures of both orbits were negative. Pupils were normal and media clear. The fundus of the left eye was normal; that of the right eye showed a grayish, translucent edema of the entire macula, with a small reddish spot in the center. Tangent-screen field showed a 2° central scotoma for the $1/2,000$ isopter.

Reexamination in two weeks showed the retinal edema to have partially subsided but to be still easily visible, with considerable increase in foveal pigmentation and the appearance of an early hole in the macula. There was no evidence or history of contusion of the eye by a solid object.

SOLAR RETINITIS

Only two cases have been seen which I felt could be unquestionably called solar retinitis. Many cases of macular pigmentation, macular edema, and hole in the macula have been reported from the Pacific area of war and have been attributed to damage by actinic rays because of their history of exposure to glare from coral sand and water. Thygeson²⁹ reports seeing many such cases in aviators after repeated high-altitude flights. It is possible that some of these cases were actually due to the action of infrared or ultraviolet rays on a sensitive retina. Their description, however, tallies much more nearly, both as to subjective symptoms and objective signs, with angiospastic retinopathy produced by vasomotor disturbances initiated by psychic trauma, fatigue, or increased use of tobacco in an autonomically unstable individual.

I have seen some of these cases returned to the United States from the Southwest Pacific with the diagnosis of actinic-ray ophthalmia and have compared them with severe cases of central angiospastic retinopathy from the Aleutian Islands area where exposure to the sun was not an etiologic factor. In their end stages, they are clinically identical.

Some years ago Verhoeff and Bell³⁰ exposed an eye that was to be enucleated to prolonged ultraviolet irradiation with resulting loss of vision but with very rapid recovery. They were unable to demonstrate any retinal lesions due to ultraviolet rays.

The same authors showed that the

effects known as "eclipse burn of the retina" were wholly thermic and due to concentration of solar energy upon the retina by the refractive system of the eye itself. Although there have been undoubted examples of eclipse blindness, the majority of such cases give but a vague and indefinite history of exposure and visual loss.

In the two cases of solar retinitis to be reported, there was unquestioned exposure to direct sun rays, augmented by concentration of the rays by optical instruments.

Cordes,¹⁹ in his report for the National Research Council, cites several practically identical cases described to him by various Naval medical officers.

Case 1. W. H., a 26-year-old seaman, first class, was stationed as lookout on a small aircraft carrier. He was using a monocular telescope and searching for enemy planes. Since, in attacking, the planes usually "come in from the sun," he had kept his glass focused in that general direction and had noticed several transient blurrings of vision which, however, rapidly cleared. Upon receiving a report that planes were approaching, he had looked directly into the sun and immediately noticed a very sharp and severe pain in the eye and a complete obscuration of vision. The pain continued to be very intense and seemed to be located deep in the eye or orbit. Vision was limited to light perception. Upon examination in the sick bay, a note of "a marked haziness of all the retina temporal to the disc" was made in his health record. When hospitalized one month later, vision in the right eye was reduced to 20/200. There was still some edema of the macula of the right eye and considerable pigment disturbance; the fovea was replaced by a deep-red, "punched-out" hole. The pain in the eye was still severe.

Case 2. P. J. T., a boatswain's mate, second class, aged 29 years, was acting as lookout aboard his ship and inadvertently followed a plane directly "into the sun" with a pair of binoculars. There was immediate severe pain in both eyes and marked loss of vision so that he had to be led into sick bay, where examination showed a "grayness of both retinas temporal to the disc, with a small hemorrhage in its center." It is thought that this "hemorrhage" was the red spot in the fovea which, when seen three days later, showed the typical picture of bilateral Berlin's opacity of the macula.

Vision was reduced to 4/200 in each eye, upon examination in the hospital. There was gradual improvement in vision during the next month and when last seen, vision was: R.E., 20/70; L.E., 20/100. There was a heavy granular pigmentation of both maculas, with sharply outlined holes developing in both foveae.

These lesions are thought to be the result of localized vasospasm of the retinal arterioles and capillaries in the macula initiated by thermal or infrared rays and followed by compensatory vasodilation, increased capillary permeability, severe edema, autolysis of the retina, and, finally, hole in the macula.

SUMMARY AND CONCLUSIONS

1. The relationships between the eye and the autonomic nervous system are reviewed with special reference to possible effects on ocular physiology.

2. The autonomic stimuli are enumerated and found to be intensely active under wartime conditions of living. Special emphasis is placed on the importance and frequency of psychic trauma as a cause of autonomic instability and of the production of both physiologic or functional and pathologic or organic ocular changes.

3. Clinical studies have been made on autonomically unstable individuals, including certain studies on the peripheral vascular system. These have been correlated with certain physiologic dysfunctions and pathologic changes in the retina.

4. The clinical picture of vasoneurotic diathesis of the autonomically unstable person is described, and it is noted that the only constant factor in all cases of central angiospastic retinopathy is this autonomic instability.

5. The ocular manifestations of autonomic-nervous-system dysfunction reported were as follows: (a) central angiospastic retinopathy; (b) ocular changes in Raynaud's disease; (c) amaurosis fugax; (d) migraine; (e) commotio retinae. Typical case reports of each condition are presented.

6. It is emphasized that the differences between amaurosis fugax, central angio-

spastic retinopathy, and Raynaud's disease are those of degree only.

7. The condition known as Migraine is a cerebral vasospastic disturbance with predominant ocular symptoms.

8. Commotio retinae, which embraces all conditions producing retinal edema from chemical vasomotor disturbances, is a local rather than a general autonomic response.

9. Psychic trauma in a susceptible individual can produce as profound organic changes in connection with the autonomic nervous system as extremes of temperature, anoxemia, or direct physical trauma. The greatly increased wartime incidence of certain disturbances of autonomic origin can be explained in no other way.

10. The almost constant association of pain with these ocular lesions can best be explained as causalgia or sympathalgia.

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PEMPHIGUS CONJUNCTIVAE*

REPORT OF THREE CASES

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Pemphigus conjunctivae is a slowly progressive, chronic, cicatrizing, keratoconjunctivitis of unknown etiology, frequently associated with vesicular lesions of the mucous membranes and occasionally with cutaneous involvement. It is characterized by an absence of constitutional symptoms and a benign course as concerns life.

Pemphigus is usually classified as acute and chronic pemphigus vulgaris, pemphigus vegetans, pemphigus foliaceus, pemphigus erythematosus (Seneear-Usher), and pemphigus conjunctivae or benign mucous-membrane pemphigus. The latter type has been described as a distinct entity by Klauder and Cowan,¹ who distinguish it from chronic conjunctival shrinkage and scarring accompanying a number of skin diseases, most of which exhibit blebs (bullous eruption following vaccination, dermatitis herpetiformis, erythrodermia ichthyosiformis, and epidermolysis bullosa dystrophica). The condition known as acute ocular pemphigus and characterized by a pseudomembranous conjunctivitis, stomatitis, severe prostration, and a cutaneous eruption is classified by them as a severe atypical form of erythema exudativum multiforme (Hebra).

The incidence of pemphigus conjunctivae is probably greater than previously believed. Lever and Talbott² saw 62 cases of pemphigus at Massachusetts General Hospital between 1921 and 1936, 10 of which (16 percent) were of the conjunctival type. Rycroft³ saw four cases at

Moorfield's in five years and believed the disease was not uncommon. Cutaneous pemphigus, particularly pemphigus vulgaris, is more common and is associated with a higher mortality in Jews, but no racial difference has been noted in the conjunctival type. There is a relatively even distribution between sexes in the cutaneous types, but the conjunctival form occurs more commonly in the female. The disease is usually one of later life, the average age in Lever and Talbott's² series of 10 cases being 61.6 years.

Parsons⁴ states that early in the disease the conjunctiva shows considerable swelling due to edema and lymphoid infiltration. Later, the conjunctival epithelium is much thickened and sends coarse plugs into the subconjunctival tissue. There is marked infiltration of the submucosa with round and spindle cells and enormous hypertrophy of fibrous tissue.

Lever and Talbott⁵ found a reduction in blood-serum protein, sodium, calcium, and chlorides in acute and chronic pemphigus vulgaris and pemphigus vegetans but no serum abnormalities in the conjunctival type. Mulvehill⁶ found consistently low serum albumin fractions in 10 cases of pemphigus but in no case was there ocular involvement. Pels and Macht⁷ have devised a test which depends upon marked inhibition of growth of *Lupinus albus* seedlings when immersed in a nutrient solution containing pemphigus blood serum. It has been positive in all types of pemphigus including pemphigus conjunctivae.

There are no symptoms characteristic of the ocular phase of the disease. Ini-

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tially, patients complain of a moderate photophobia, burning, itching, and similar complaints associated with a mild, chronic conjunctivitis. In the later stages, intermittent conjunctival injection, dryness, and persistent foamy, ropy secretion are most prominent. Formation of symblepharon and conjunctival scarring develops insidiously and without a readily apparent ocular inflammation. Cicatricial contracture may cause trichiasis, and the symblepharon may become so extensive as to cause complete ankyloblepharon with ultimate loss of the globe. The cornea may be covered with a cuticularlike membrane with serious diminution of vision long before involvement secondary to complete ankyloblepharon.

The mucous membranes of the nasal pharynx, mouth, esophagus, rectum, and vagina are frequently involved. Early, there are vesicles of varying size which eventually rupture, leaving macerated areas. These areas heal slowly and result in atrophic scarring and contracture with deformity in the part involved.

The skin is infrequently involved according to most writers. However, Urbach⁸ states that pemphigus of mucous membranes may exist for one, two, or three years, and then suddenly break out over the entire body. The skin eruption is usually localized particularly on the face and initially presents blebs which rupture and then crust. The lesions heal slowly without scarring. The presence of cicatricial changes in the skin has been described rarely, Lever⁹ finding but five cases previously reported to which he added six of his own.

Numerous theories as to the cause of pemphigus have been proposed but none confirmed. Among these theories are the toxic, neurotropic, infectious (*B. pyocyaneus*, *B. pemphigus*, *B. streptococcus*), vitamin deficiency, virus (Urbach), and suprarenal insufficiency. Recently Gal-

lardo and Hardy¹⁰ isolated a virus closely related to the vaccinia virus in a case of pemphiguslike keratoconjunctivitis.

The status of treatment of pemphigus has not changed since 1930, when Riecke¹¹ wrote: "Pemphigus shows such a fitful and paradoxical spontaneous course that only too easily can erroneous conclusions on the value or lack of value of any line of treatment be drawn." This statement is emphasized by the number of drugs which have been recommended and condemned. In the text by Ormsby and Montgomery,¹² the following treatments are mentioned: quinine, arsenic as sodium arsenate, acetarsone (stovarsol), salver-san, cacodylate of iron, tryparsamide, soluble mercurochrome, moccasin venom, germanin, exclusion of salt from diet, colonic irrigations, strychnine, autogenous vaccine, cod-liver-oil and malt preparations, viosterol, and sulfanilamide. Recently, in a careful study, Lever and Talbott⁵ have used adrenal-cortical extract and dyhydrotachysterol with encouraging results in all except pemphigus conjunctivae, in which the course of the disease in two patients was not affected.

Trichiasis and xerosis are frequent ocular complications. Dimitry¹³ recently recommended the use of choline as a wetting agent in ocular pemphigus and stated that the local use of the drug has made epilation unnecessary. The Van Milligan operation is of transient value only, as the transplanted mucous membrane is eventually converted to scar tissue together with the adjacent conjunctiva. Surgical separation of the symblepharon is of no value, for the adhesions re-form, in spite of any agent placed between the epithelial surfaces.

CASE REPORTS

Case 1. A 26-year-old, white soldier, was admitted to Wakeman General Hospital, November 19, 1945, complaining of

recurrent redness of the eyes. He stated that, while hospitalized for pneumonia in November, 1944, he had developed a mucopurulent conjunctivitis which had recurred intermittently ever since. In July, 1945, a severe skin inflammation, diagnosed as impetiginous dermatitis, cleared with penicillin systemically, but since then had recurred about the face every few weeks. When 4 years old, he had a severe dermatitis with sores over the body and, when aged 9 years, had an empyema which necessitated a rib resection. He gave a history of high fever and general prostration whenever he received sulfonamide drugs.

Uncorrected vision in each eye was 20/20. The conjunctiva was atrophic and deeply scarred, particularly over the tarsi. A ropy, white secretion was present in the inferior fornices. The cul-de-sacs were markedly shortened and contained linear, horizontal, white scars which were elevated above the adjacent conjunctiva. Symblepharon bound the atrophic caruncles to the lower lids, and the semilunar folds were obliterated by adhesions between their free edges and the globe. A symblepharon extended from the inner margin of the upper lid to the globe, and traction of the lid resulted in an ischemic linear area extending from the point of adhesion to the corneal limbus.

Physical examination showed bilateral, chronic, maxillary sinusitis and right basilar bronchiectasis, which were asymptomatic.

Blood-serum protein, chlorides, calcium, cholesterol, nonprotein nitrogen, sugar, and sedimentation rate were normal. Agglutination for brucella and tularemia were negative as were the Kahn, Frei, and Mantoux tests. The white blood count was within normal limits, and the differential showed no abnormality other than an eosinophile count of 4 to 6 percent.

A small section of the right, lower lid was normal except for moderate round-cell infiltration of the subepithelial tissue.

At no time were vesicles of the conjunctiva, mouth, or pharynx noted and, other than the conjunctiva, there was no mucous-membrane involvement. Crusting lesions of the face were present intermittently and responded quickly to penicillin intramuscularly. Penicillin (1,000 units to 1 c.c. in solution) used locally in the eyes caused much of the secretion to disappear and seemed to limit the number of attacks of the conjunctival inflammation, but the condition remained essentially unchanged during four months of hospitalization.

Case 2. A 28-year-old, white soldier was admitted to Wakeman General Hospital, January 15, 1946, complaining of dryness and recurrent inflammation of the eyes present since March, 1942. He had been hospitalized at that time for pneumonia and treated with a sulfonamide drug to which he was sensitive. A concomitant conjunctival infection was treated with sulfathiazole ointment and caused a severe local reaction. Since then, the ocular inflammation had recurred periodically but was not incapacitating.

Vision was 20/70 in each eye corrected to 20/30 with a $-1.25D.$ sph. $\odot +3.50D.$ cyl. ax. 90° in the right eye; and a $-1.00D.$ sph. $\odot +3.00D.$ cyl. ax. 95° in the left. The palpebral conjunctiva showed diffuse atrophic scarring and several symblepharon extended from the inner margin of the upper lid to the globe. The semilunar folds were obliterated by adhesions, but the caruncles showed no scarring. In the outer portion of each inferior cul-de-sac, the conjunctiva was thrown into folds and appeared redundant but was firmly adherent to the underlying tissue. The remainder of the ocular examination was negative.

The hard palate showed white scars extending from the teeth to the median raphe, and, on one occasion, a macerated, red area was present on the buccal mucosa of the cheek. Vesicles formed occasionally on the gums and ruptured but did not appear to cause scarring. A vertical, linear scar was present on the left inferior turbinate. The remainder of the physical examination was negative.

Blood-serum protein, chlorides, calcium, cholesterol, sugar, and sedimentation rate were within normal limits. The Kahn, Frei, and Mantoux tests were negative, as were agglutination for brucella and tularemia. The white blood count was normal and showed 2-percent eosinophiles. A small section of tissue removed from the left, lower eyelid revealed no pathologic changes.

The patient's condition remained unchanged during hospitalization. Vesicles of the gum and mild, recurrent conjunctival injection were the only evidence of activity. The skin was not involved at any time.

Case 3. A 23-year-old, white soldier was admitted to Wakeman General Hospital, from overseas, May 30, 1945, complaining of diminution of vision and marked weakness. He had been wounded in the right foot and taken prisoner in Germany, November 15, 1944. While hospitalized for the foot wound, he developed a severe dermatitis of the head and neck which caused his eyelids to swell to complete closure. He was treated at an eye clinic, and the inflammation subsided, but vision was severely impaired. After recapture in April, 1945, the diagnosis of pemphigus conjunctivae was suggested by H. A. Mosher, Capt. (MC), at an Army General Hospital in Europe. In the course of evacuation to the United States, the patient developed a weakness of the lower extremities and was unable to walk.

He stated that impetigo had covered his body in 1943 and had disappeared without residue. Other than this, his medical history prior to capture was essentially negative.

Vision was: R.E. 20/300, corrected to 20/40 with a +3.75D. sph. \ominus -7.00D. cyl. ax. 40°; L.E., 20/400, corrected to



Fig. 1 (Newell and Greetham). Case 3. Symblepharon involving cornea.

20/50 with a -1.25D. sph. \ominus -1.75D. cyl. ax. 45°. The conjunctiva was shrunken, diffusely cicatrized, and pale in appearance, with many blood vessels obliterated by scar tissue. The cul-de-sacs were shallow, the caruncles scarred with numerous discrete linear areas, and the semilunar folds obliterated. A large number of symblepharon were present in the superior fornices, which were adherent to the globe. The left eye showed a heavy symblepharon which swept down from the superior lid margin to the inner one half of the cornea. A diffuse opacity, deep in the substantia propria, was present immediately temporal to the attachment of the symblepharon to the cornea. A large number of superficial epithelial opacities were present bilaterally. The circumference of the limbus showed diffuse clouding of the substantia propria extending inward 2 to 4 mm. and covered

with superficial, new blood vessels which, in some areas, extended beyond the opacity. The irides were slightly atrophic and bound to the anterior lens capsule by numerous darkly pigmented synechiae. The anterior capsule of each lens was diffusely opaque, particularly the left. There was no aqueous flare, and the remainder of the ocular examination was negative.

Physical examination revealed a healed bullet wound of the right foot, generalized muscle tenderness, absence of the cremasteric and patellar reflexes, and a hypoaesthesia to the level of the second lumbar segment. The skin of the posterior surface of the right calf and anterior surface of the left wrist showed circular, atrophic scars, measuring 2 cm. in diameter, depigmented centrally, with a ring of pigment at the periphery.

Blood-serum protein, chlorides, calcium, cholesterol, nonprotein nitrogen, and sedimentation rate were normal. The albumin-globulin ratio was reversed on several occasions. Agglutination for brucella and tularemia were negative as were the Frei, Kahn, and Mantoux tests. White blood count was normal, but the differential showed 5-percent eosinophiles.

The patient was placed on a high caloric, high nitrogen, and high fat diet, supplemented by vitamins orally and parenterally, and given 300,000 units of penicillin intramuscularly in divided doses. In several weeks, the muscle tenderness and hypoaesthesia disappeared, and the deep-tendon reflexes returned. Locally, atropine, adrenalin, cocaine, and neosynephrine were used in an attempt to break the posterior synechiae, and penicillin was used as an antiseptic. The cataract in the left eye progressed to maturity and vision diminished to light perception. On several occasions, multiloculated vesicles were noted at the corneal limbus of the right eye and on the conjunctival surface

of the lower lids. They did not rupture on repeated examination and disappeared spontaneously after four or five days. They were not associated with gross inflammation of the eye and did not give rise to symptoms. There has been no increase in the number of symblepharon since admission to this Hospital, and the lens opacity in the right eye has remained stationary.

COMMENT

A number of eye and skin diseases associated with conjunctival scarring and shrinkage were considered in making the diagnosis of pemphigus conjunctivae in these patients. There was no history of ocular injury with chemical agents, and the onset of the disease was not associated with vaccination. Trachoma was excluded in the absence of corneal involvement with typical pannus formation, lack of papillary hyperplasia, and the large amount of symblepharon formation. Erythrodermia ichthyosiformis and epidermolysis bullosa dystrophica are largely congenital conditions and have their onset in infancy. The absence of pruritic skin lesions, lack of involvement of the skin of the sacral triangle and scapular area ruled out dermatitis herpetiformis. The iodine-patch test was also negative in each of these patients and, while not absolutely diagnostic, indicated the disease was not dermatitis herpetiformis.

Grönblad¹⁴ has described conjunctival shrinkage following sensitivity to luminal, and Kasselberg¹⁵ has described a pemphiguslike skin eruption with symblepharon formation occurring in a patient sensitive to sulfamerazine. In that both Cases 1 and 2 gave a history of sensitivity to sulfonamides, it is possible that the ocular condition represented a drug sensitivity rather than pemphigus conjunctivae. The occurrence of vesicles in the mouth in Case 2 long after the drug was used led us to believe, however, that

the condition was not one of drug sensitivity. The large number of adhesions and the intermittent conjunctival injection continuing after the drug was discontinued indicated that the condition was most likely pemphigus conjunctivae in both cases.

The reversal of the blood-serum, albumin-globulin ratio observed in Case 3 was probably caused by nutritional deficiency rather than by pemphigus conjunctivae. The low degree of eosinophilia in each case is consistent with previous reports and is in contrast to the large in-

crease in eosinophiles commonly seen in cutaneous pemphigus.

Bilateral uveitis with complicated cataract formation, as was present in Case 3, has not, to our knowledge, been reported previously as occurring in pemphigus. Although no etiologic factor was found, we believe that it occurred coincidentally rather than secondary to the pemphigus conjunctivae.

Penicillin was of no value in the treatment of the disease except that it appeared to lessen the amount of ocular secretion when used locally.

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THE EFFECTS OF ATABRINE ON THE HUMAN VISUAL SYSTEM*

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Atabrine (Quinacrine hydrochloride) is widely used today in the treatment of malaria. A review of the available literature fails to reveal reference to any temporary or permanent effects of this drug upon the human visual system. To this end, a study was undertaken to investigate (a) visual changes with increasing blood-atabrine levels, (b) any alteration with decreasing atabrine levels, and (c) the effects on vision of long-continued atabrine administration.

HISTORY

In the early campaigns in the Southwest Pacific area, malaria inflicted the greatest number of casualties, with a resultant serious impairment of the military effort. Quinine was limited and ineffectual. Atabrine was first used in widely varying dosages, and many side effects and clinical observations have already been recorded in the literature.

Most malaria was of the tertian form. There were many somatic complaints, including retrobulbar pains which were often aggravated by ocular effort. In many instances, these were definitely connected by the patient with a specific malarial recurrence. Refractive errors varied widely, and neuromuscular abnormalities were rarely seen. While perimetric examinations were invariably normal, a high rate of various-sized scotomas were found, seemingly proportional to the number of malarial recurrences. Finally, a group of our own medical officers returned from tropical service with some of the previously noted symptoms and changes.

Many other factors of possible etiology with unknown influence had to be considered: Retinal fatigue due to the tropical sunlight; cerebral fatigue and mental disturbances after combat; constitutional exhaustion following marked loss of weight common to combat; febrile tropical disease such as dysentery and dengue; and, lastly, the unknown toxic action of atabrine.

Solution of this problem was indicated, but the individual normal for each patient's system could not be determined in retrospect. Fortuitous circumstances permitted a scientific approach to the problem in that our organization, an affiliated general hospital, had been established for two years in an isolated subtropical section of Australia where the combat factors were absent and the use of any anti-malarial drug had not been necessary. Furthermore, a change to tropical service was imminent. All of the illnesses and temperaments of the coöperating 39 officers with the requisite normal ocular systems and 6 others with minor small scotomas were well known. Because of these circumstances it was hoped to exclude all factors except those possibly connected with atabrine administration.

PART I: PROCEDURE

The basic preliminary examination of the visual tracts included the external inspection, the determination of visual acuities, neutralization of refractive errors with the aid of full homatropine cycloplegia, the detection of neuromuscular abnormalities, perimetric (1/2000/white and 3/330/white, blue and red/9 candlepower) and tangent screen (1/ and 6/2,000/white) investigations, and the actual sketching of the disc portion

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of the fundus. For the purposes of this investigation atabrine was issued in an experimental combination of dosages which individually were then officially recommended² in the Southwest Pacific area: 0.1 gm. daily, as in the suppression of clinical malaria (two weeks); 0.2 gms. daily, as in the rapid atabrinization obtained when approaching a hyperendemic area (one week); and in successive daily dosages of 1.2, 0.9, 0.3, 0.3, and 0.3 gm., as in full antimalarial atabrinization. Observations could thus be made at the different blood-atabrine levels. In actual clinical practice, a full course of atabrine for treatment would never be required immediately following 0.2 gm. per day for one week. The Chiefs of the Medical and Surgical Services selected eight of the volunteers to act as controls.

On the 7th, 14th, 21st, and 28th days, the basic examination was repeated except for the checking of the refractive errors. The laboratory determination of the blood-atabrine levels for the individual officers had to be discontinued because

FINDINGS

Of the 45 officers who entered upon this part of the investigation, 6 controls and 32 taking atabrine completed it. The following data were recorded concerning of the 32 taking atabrine:

1. There were no changes in external appearance, in central visual acuity, in extent of fields with white or colored targets, or in neuromuscular action.

2. Tangent-screen examinations revealed that field changes appeared: (a) 17 officers developed 41 scotomas averaging 12.9 by 15.7 cm. in size. Twenty-four of these were within 20 degrees of the fixation point and varied in period of onset and in duration. (b) There was a gradual minor increase (to a total of 1 cm.) in the size of the blind spots, with increasing blood-atabrine levels. (c) The five initial scotomas showed decreased size in two cases, no change in one case, and increase with development of a second scotoma in two cases. (d) Ten officers had no demonstrable changes. (e) The changes may be tabulated as follows:

Start	16 gamma per liter calculated		30 gamma per liter calculated		79 gamma per liter calculated	
	1st week	2d week	3d week	4th week	5th week	
Subjects	5	6	8	13	12	8
Scotomasa	7	9	15	19	26	11

of technical difficulties. The theoretical group levels (based on the extensive studies at the Fort Knox Armored Research Laboratory, as reported in December, 1943)¹ were:

	Gamma per Liter
14 days at 0.1 gm.	16
additional	
7 days at 0.2 gm.	30
1 day at 1.2 gm.	67
1 day at 0.9 gm.	79
4 days at 0.3 gm.	73

3. Retinal changes found on ophthalmoscopic examination were limited to a slight increase in the pinkness of the discs. No capillary measurements were made.

4. Complications. Some of the clinical observations previously recorded by other authors³ appeared in this study and are sufficiently pertinent to mention briefly: (a) Four officers had serious mental changes during atabrine levels of the fourth week. One required confinement in the closed psychotic ward; a second was considered for similar treatment;

and two others were sufficiently confused to require temporary relief from duty. All returned to normal with the cessation of medication. (b) Nineteen of the other officers exhibited the minor cerebral and gastro-intestinal stimulations reported by other authors.

Of the six controls, three developed six temporary scotomas (3 each with 1/ and 6/2,000/white) during the 2nd and 3rd weeks after a positive blood-alcohol level.

PART II: PROCEDURE

Atabrine was discontinued on the 29th day. In the period from the 60th to the 74th days, the examinations were repeated except for the 3/330 perimetries (equipment crated) and the check of refractive errors.

FINDINGS

All but five of the scotomas developed during Part I disappeared. The remaining scotomas were unchanged and were found in three individuals.

PART III: PROCEDURE

Atabrine was recommenced on the 125th day, when approaching the tropics: 0.2 gm. daily for seven days was administered, followed by 0.1 gm. daily throughout the stay in the tropics. The same expert technicians and equipment were used, and the illumination was carefully reduplicated and checked with a light meter.

The basic examination, except for the refraction portion, was repeated in the period from 243rd to the 317th days, when it was considered that the investigation

was of sufficient duration for definitive impressions to have been established. The earlier final determinations were necessitated by the impending separation of the individual from the organization for duty elsewhere.

FINDINGS

Of 36 officers completing this section, 6 new scotomas of the previously found average size were present in three subjects. There were no other changes from the normal.

SUMMARY AND CONCLUSIONS

An investigation of the effects of atabrine upon the human visual system was completed under advantageous circumstances. The blood-atabrine group levels rose to a calculated 79 gamma per liter under circumstances not to be expected in clinical practice.

Scotomas and blind-spot enlargement of minor importance accompanied the suddenly attained high blood-atabrine levels and disappeared with the lowering of the levels.

No other changes occurred in the human visual system during brief or prolonged atabrine administration.

There were no visual-system contraindications to the use of atabrine.

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Grateful recognition of the assistance of 1st Lt. Erleen F. Jamison (A.N.C.), Tech. Sgt. Carl J. Ryan, and T/3 Harold A. Skeem is hereby made.

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DUST-BORNE INFECTION IN OPHTHALMIC SURGERY*

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Asepsis in ophthalmic surgery has long been a problem peculiar unto itself. Of late years, there has been a tendency to conform more closely to the ideas of general surgery—such as the wearing of rubber gloves. But the incidence of infection still remains only slightly altered.

It is well known that by no possible method can the conjunctiva be rendered completely sterile. The discussion concerning the value of cultures taken before operation still finds proponents on both sides of the question. Fortunately for surgery upon the eye, the lysozyme of the tears shows a high bactericidal potency, and the lacrimal apparatus is so constructed that the wounds made at operation are constantly bathed in tears following these operations.

The wonder is not that there is still a certain percentage of infection, but rather that the incidence is so small. This fact, however, should give no grounds for complacency. There is nothing more harrowing in the experience of the ophthalmic surgeon than the discovery of an eye bathed in pus at the first postoperative dressing. Even with all our recent advances in bactericidal drugs and therapy, seldom, indeed, can such a situation be saved. It, therefore, behooves us to search in every direction for any additional precautions that may prevent such tragedies.

During the years of 1926 and 1927, the late Dr. A. E. Ewing was experimenting with various solutions that might sterilize the sharp instruments used in ophthalmic operations without injury to them. By his

work, I was stimulated to investigate this problem. My first paper on the subject appeared in the *American Journal of Ophthalmology*, in 1928.¹ The second was presented before this society in 1940,² and the third, written in conjunction with Mr. William Moor, was published in the *American Journal of Ophthalmology* in 1942.³ For reasons elaborated in the second paper, the most practical, all-around satisfactory method of accomplishing the desired results appeared to be by means of chemical solutions. That recommended in the last of these three papers, known as No. 4, has been in use by the Department of Ophthalmology of Washington University in all eye surgery since about February 1, 1941. The formula may be written:

Liquor cresolis compound	8.0 c.c.
Oil of lavender	2.0 c.c.
Thymol crystals	2.0 gm.
Ethyl alcohol 95%	88.0 c.c.

Mr. Moor and I were able to demonstrate by experiments recorded in that paper that clean instruments contaminated by cultures made up of various types of virulent organisms could be sterilized by immersion in that solution for a period of one-half minute. Four and one-half minutes, however, were required to sterilize similar instruments, previously soiled by blood and serum, when subjected to the same cultures, plus a heavy concentration of spore-bearing hay bacilli.

It was demonstrated that knives, dropper bulbs, and the like, immersed in this solution for very long periods of time, suffered no deterioration. Three knives, referred to in the third paper, have remained in it since November 14, 1940. They show no dulling of the edges, nor

*From the Department of Ophthalmology, Washington University School of Medicine. Read at the eighty-first annual meeting of the American Ophthalmological Society at Hot Springs, Virginia, November, 1945.

injury to the handles other than an increased translucency of the ivory of one of them. The aluminum and the nickel-plated brass handles of the other two show no change whatsoever. Nor has there been any electrolytic action among the three, despite close contact throughout this long period of immersion. Two rubber bulbs were likewise unaffected in any way after $2\frac{1}{2}$ years. Nor have any of the undesirable effects upon aluminum, encountered in the use of the germicide recommended in the second paper, in which formaldehyde was one of the constituents, been encountered with this solution.

During the past summer, and especially during the month of September, several infections having occurred in the eyes of patients operated upon for cataract in McMillan Hospital, of the Washington University School of Medicine, it seemed desirable to recheck the tests previously made, this time under operating-room conditions, and, also, while studying the action of the germicide, to conduct other experiments with a view to a determination of where contamination might be taking place, should it prove that the sterilizing solution was acting in a satisfactory manner.

Consideration of all the possibilities shows that such infections take place through: (1) contamination residual in the conjunctiva, glands of the lids, lacrimal apparatus, skin; (2) the hands and gloves of the surgeons, assistant, and nurses; (3) droplet infection through the masks of the participants; (4) dust-borne organisms.

This paper, as indicated by the title, does not purport to deal with any of the first three sources, but does attempt to study the fourth route of infection and to point out possible measures that may be instituted to combat contamination of this nature.

For a better understanding of the various stages through which the instruments pass in these experiments, it might be well to note the procedure formerly practiced in our operating rooms. The towels and dressings were sterilized in the usual steam sterilizers. They were then laid upon tables and covered in the usual manner until ready for use. The instruments were first placed in two porcelain dishes, approximately 8 in. long by 5 in. wide, filled with solution No. 4 to a depth of about 1 in. They were allowed to remain there for from 5 to 15 minutes, after which they were passed through a water bath in a similar porcelain dish. No particular effort was made to cover any of these vessels. Following the water bath, the instruments were laid on towels, from the sterilizer, where excess water was removed, the towels, of course, becoming more or less damp as the last ones were dried. They were then placed upon the operating table.

For the purpose of these experiments, instruments of all sorts were removed at all stages of the procedure, as well as from the operating tables, at the close of a number of operations, and tested by immersion in sterile broth cultures. Care was taken not to open and close scissors, needleholders, clamps, and like instruments when introduced into the bactericide, as it was felt that this precaution would often be omitted by the nurses under the pressure of heavy schedules. It may be noted here that, despite this omission, all instruments were found sterile when tested directly upon removal from this solution.

In the first of these five experiments, all shown in table 1, four instruments, taken directly from the germicide, were cultured. In the second, four more were tested upon removal from the water bath, which had stood for some time uncovered on the preparations table. The cultures

from the first four were all negative after 96 hours. Those from the second four were all positive after 24 hours, definitely showing contamination of the water bath. In the third experiment, the water bath was poured immediately before use and thereafter kept constantly covered. Four instruments cultured upon removal from this bath gave negative results after 96 hours. The fourth experiment shows the results obtained from the tests run upon

profusion on all plates exposed in the operating room from time to time, indicating air-borne organisms as the source of these contaminations.

It would seem from these results, with 36.23 percent of instruments prepared for operation contaminated even after great care concerning the protection of the water bath had been adopted, that the procedure followed in our operating rooms, at least, was inadequate. And the

TABLE 1
COMPARATIVE TESTS MADE UNDER OPERATING-ROOM CONDITIONS

	Number of Instruments	Hours Cultured 24 48 96	Percent Positive
Experiment 1 Instruments cultured from sterilizing solution	4	- - -	0
Experiment 2 Instruments cultured from exposed water bath	4	+ + +	100
Experiment 3 Instruments cultured from unexposed water bath	4	- - -	0
Experiment 4 Instruments cultured from dry towels	4 2 1	- - - + + + - - +	42.86
Experiment 5 Instruments cultured from wet towels	5 1 1	- - - + + + - - +	29.60

instruments taken from dry towels, four on one day and 3 on another. From these seven instruments, four cultures remained negative throughout, two were positive in 24 hours, while one was contaminated after 96 hours. In the fifth experiment, seven more instruments were tested upon removal from wet towels, again four on one day and three upon another. Here, five were negative after 96 hours, one was positive in 24 hours, and one at the 96-hour inspection. It is of interest to note that the predominating organism in all positive cultures was the *Bacillus subtilis*, which also appeared in

probabilities are that much the same, or worse, prevail in most institutions. Certainly the indications are that dust-borne organisms have been playing a large part in the contamination of water bath, towels, and instruments. What, then, can be done to reduce the number of such infections? The answer must lie along the line of air sterilization, or, at least, of protection from atmospheric dust. Our hospitals have been woefully slow to put measures directed toward air sterilization into practice, although the benefits of such procedures are well recognized, and have been employed for some time by com-

mercial houses all over the country. Sterilization of the air has been found highly practical and of the utmost economic benefit in canneries, packing houses, and the like. Where the balance sheet is affected, a remedy has been sought and the means found to put that remedy into practice. Where human happiness is at stake, the means has, as yet, not been

so recovered have made very powerful exotoxins which (in one instance) have killed a rabbit in two minutes."

Here, again, in this connection, it is interesting to note that in those infections occurring in our operating rooms last summer and fall, and also one in April of this year, from which cultures were made, large, gram-positive, motile, spore-form-

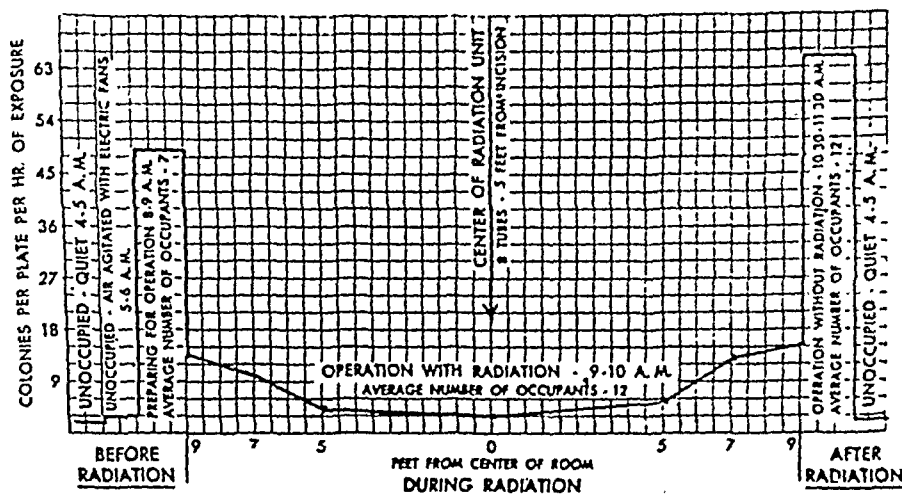


Fig. 1 (Post). Chart showing effect of sterile lamps upon the bacteria content of the air of operating rooms (by permission Westinghouse Lamp Division).

found to correct the evil, except in a very limited number of instances.

Dr. Deryl Hart,⁴ writing from the Department of Surgery of Duke University Medical School and Hospital, upon "Sterilization of the air in the operating room with bactericidal radiation," reported upon results obtained in 132 extra-pleural thoracoplasties done under sterile lamps. He found that infection, mortality, and postoperative complications were reduced by half. It is his opinion that contamination of the air can be eliminated almost completely by means of bactericidal radiation. Dr. David T. Smith,⁴ from the same department, in discussing Hart's paper, stated, concerning bacteria recovered from the plates exposed in the operating room: "I would not have believed that these were pathogenic bacteria . . . had it not been that organisms

ing organisms, probably hay bacillus, were recovered, similar to those found in the experiments previously reported.

At present, efforts to sterilize the air are directed largely toward direct action on the air and its dust content by the use, either of so-called sterile lamps or by various bactericidal solutions sprayed into the air. In addition, the effectiveness of either method can be enhanced by the application of oil solutions to blankets, cotton sheets, and floors.

Sterile lamps have been developed extensively and are in use commercially at the present time on a somewhat comprehensive scale. Figure 1, taken from a report of the Westinghouse Corporation of experiments conducted by their laboratories upon air sterilization by sterile lamps, gives a rather startling representation of the effect of these lamps upon the

bacterial content of the air of operating rooms during the course of a busy day. From this graph, it will be seen that the bacterial count, though low at first, while the room was unoccupied, rose enormously during preparation for operation, then fell again almost to its undisturbed state during irradiation, despite continued activity, eventually rising to a still greater height when irradiation was discontinued, although activity in the room remained high, only falling once more to the original condition after several hours of vacancy.

In using sterile lamps, two practices may be employed: (1) The field of operation, tables, and other appurtenances may be subjected to the direct rays from the lamps; or (2) All the air supplying the rooms may be drawn in through conduits over large batteries of sterile lamps, as shown in figure 2, taken from another bulletin of the Westinghouse Corporation. The direct rays from the lamps are of such a nature that they cannot be allowed to fall directly upon the operative field in the case of an eye operation, nor can the surgeons operate under them without protective garments and masks. In addition, the heat generated by a sufficient number of lamps for the purpose would often make them unbearable without air conditioning. The second method of application may be satisfactory, provided ample air conditioning can be secured, as otherwise the heat generated would again be an insurmountable obstacle on many a summer day, when operations must be performed.

The second procedure, that of spraying the air with various bactericidal solutions, gives promise of becoming a practical and satisfactory method under certain conditions. Many investigators are working on this problem at the present time, as the medical personnel of all branches of the Armed Forces are interested be-

cause of its bearing upon the reduction of cross infection in barracks and other places where large groups of men are housed in crowded quarters.

In this country, Dr. O. H. Robertson,⁵ of the University of Chicago, has been active in these investigations. He, with his associates, working with propylene

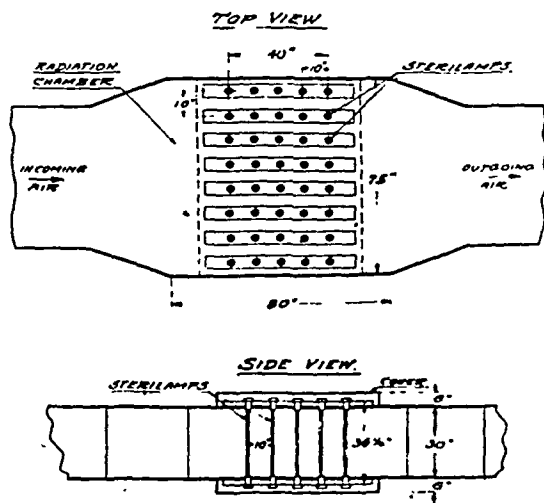


Fig. 2 (Post). Diagram showing how air supplying operating rooms may be drawn through conduits over large batteries of sterile lamps (by permission Westinghouse Lamp Division).

and, more extensively, with triethylene glycol vapor, have shown that 1 c.c. of this substance in 10,000 cu. ft. of air, is lethal to pneumococci, streptococci, and influenza virus previously injected into the air; that, in this concentration, it cannot be detected and is noninjurious to individuals, even after long exposure to its effects. It is most potent, however, at rather high humidity. For instance, the influenza virus survived less than 24 hours at a humidity of 80 to 90 percent, whereas in dry air 25 to 30 percent were recovered after 36 hours.

For its satisfactory use, it is necessary to have control mechanisms and vaporizers. Drs. Puck, Wise, and Robertson⁶ have developed a most ingenious, though simple, device, in which control depends

upon variations in the intensity of a beam of light reflected from a polished brass band onto a photoelectric cell, the amount of condensation upon the metallic surface cutting down the stimulus to the cell as the vapor concentration increases in the air, and, on the contrary, permitting greater intensity as the vapor content diminishes. The photoelectric cell may be connected to a vaporizer that can be set up to spray vapor into the air, as called for. Several types of vaporizers have been developed, one by the Research Corporation of New York, and one by Biggs and Jennings⁷ of the Technical Institute of Northwestern University.

It is obvious that this method of air sterilization, as well as that by sterile lamps, generates heat and humidity and, for accurate control of the vapor content in the air, requires a closed room, which, in turn, necessitates a satisfactory system of air conditioning for its practical application.

As suggested previously, using either type of air sterilization, the results can be greatly improved by oiling the blankets and sheets. Harwood, Powney, and Edwards,⁸ writing in the *British Medical Journal* for May, 1944, have given detailed instructions for the attainment of satisfactory oiling of these articles. After washing, blankets may be treated in the hospital laundry, using "Fixanol C," a cation-active agent, to deposit upon them a 4.8-percent concentration of oil. Cotton sheets may be treated in a similar way, followed by "Teepol," an anion-active agent, leaving a concentration of 6.7 percent of oil upon these fabrics. Although the results of such treatment cannot be detected by observation or touch, they nevertheless, remain effective for a number of months.

All observers have attributed much of the air pollution to disturbance of the dust upon the floors. It is, therefore, of

the utmost importance that some method to hold that dust be instituted. Dr. O. H. Robertson and associates⁵ have suggested that pale paraffin oil be used, which will hold dust for many weeks. On tiled floors it may, however, become slippery. Should such be the case, a solution of urea (5 percent), ninol (3 percent), and rocall (0.9 percent) may be substituted very effectively, but must be renewed every few days.

Under present circumstances, air conditioning by either sterile lamps or triethylene glycol vapor is quite impractical in most hospitals, both because of the expense involved and the difficulty in procurement of the necessary equipment. There are, however, a few simple procedures which the author wishes to bring to your attention that are of value in combating infections from these dust-borne organisms. In the first place, all towels, dressings, solutions, and instruments should be protected from dust by sterile covers as much as possible. This is obvious. The second suggestion is to recommend the practice of dipping all instruments which actually enter the aqueous or vitreous chambers into boiling water, or sterilizing solution, for a few seconds immediately before use. Such procedures have been employed sporadically for many years, but I know of no experimental studies that have been made definitively to determine their value. The writer wishes, therefore, to report here a number of experiments which have been carried out with this purpose in mind.

It is well here to point out that this work could not have been done without the assistance and many valuable suggestions of Mr. William Moor, the coauthor of the third paper on this subject. The cultures reported have been taken and read by both of us, working together. The experiments reported earlier in this paper may be considered as belonging to the

first group, and these to the second group.

In this second group, shown in table 2, 18 instruments of various types were taken as a control from eight different operating tables, following their use in operations of one sort or another upon the eye. Cultures taken from these were found positive in 14 out of the total number tested, indicating 77.77 percent contamination at the close of operation. In

which was to be introduced inside the anterior, posterior, or vitreous chamber of the eyeball into various solutions for varying periods of time, immediately before their use in the operation.

In the first of these studies, the instruments were dipped in water immediately after boiling had ceased. One instrument dipped for 1 second gave a positive culture after 24 hours; 1 dipped for 1½

TABLE 2

RESULTS OF EXPERIMENTS CARRIED OUT UPON INSTRUMENTS TAKEN FROM IDENTICAL OPERATING TABLES

Instruments Cultured	Dipping Time seconds	Number of Instruments	Hours Cultured 24 48 96	Percent Positive
Control experiment from postoperative tables	0 0	14 4	+ + + - - -	77.77
Experiment 1 After dipping in water just below boiling point	1 1.5 2 2	1 1 2 2	+ + + - + + - - + - - -	100 100 50
Experiment 2 After dipping in boiling water	1 1 2.5 2.5	1 6 1 7	- - + - - - - - + - - -	14.28 12.5
Experiment 3 After dipping in zephiran 1/3000	2.5 2.5	2 31	- - + - - -	6.66

considering this high percentage, it should be realized that these instruments have been subject to contamination by all four routes previously indicated. It would appear reasonable that if a large proportion of similar instruments taken from these same tables could be sterilized by any method, the procedure employed should be equally, or even more highly, successful in sterilizing those contaminated by dust-borne organisms alone.

The following experiments, reported in table 2, have, therefore, been carried out upon instruments taken from the identical operating tables reported in the foregoing control experiment. The same principle was employed in each instance; namely, dipping the end of the instrument

seconds was positive after 48 hours; but of 4 dipped for 2 seconds, only 2 were positive after 96 hours.

In the second experiment, boiling water was employed. The results, as shown in table 2, were that, of 7 instruments dipped for 1 second, only 1 culture was positive after 96 hours, and of 8 dipped for 2½ seconds, 1 alone gave a positive culture after 96 hours.

It would appear from these experiments that both procedures reduce the percentage of contamination to a very large extent and are well worthy of adoption. The boiling water at one's elbow is, however, somewhat of a nuisance, and on warm days definitely increases the heat and humidity. A solution was sought,

therefore, which might be substituted for boiling water; one that would cleanse the instruments without injury to them, or to the eye being operated upon, should occasional droplets be introduced into the eye in the manipulation. In general, the synthetic detergents seemed well suited for such a purpose. Of the 2,000, or more, of these which have been produced, zephiran is one of the most extensively studied and most satisfactory in action.

the eyeball upon instruments, none have thus far been brought to my attention, even though due to error a 1/300 concentration was used for about one month.

As previously noted in experiment 2, of the first group, the water bath was highly susceptible to contamination. The satisfactory results obtained by dipping the instruments into the zephiran bath suggested that a similar solution might be used for the removal of the original

TABLE 3
RESULTS OF EXPERIMENTS TO DETERMINE EFFECTIVENESS OF ZEPHIRAN 1:3,000*

	Minutes Exposed	Hours Cultured 24 48 96			Percent Positive
Experiment 4					
Aqueous solution of zephiran 1/3,000 cultured after exposure to air for	0	—	—	—	0
	15	—	—	—	0
	30	—	—	—	0
	60	—	—	—	0
	120	—	—	—	0
	300	—	—	—	0
Experiment 5					
Instruments cultured from aqueous zephiran 1/3,000 after exposed to air for	30	—	—	—	0
	90	—	—	—	0

* All instruments first sterilized by immersion for five minutes in solution No. 4.

Certainly, its effect upon ocular tissue is well understood. It belongs to the cationic group, all of which are very effective inhibitors of bacterial metabolism at 1/3,000 concentration, and some even at a much greater dilution.

In the third of this group of experiments, therefore, an aqueous solution of zephiran 1/3,000 was substituted for the boiling water. The results, as shown in table 2, experiment 3, were most satisfactory. Of 33 instruments dipped in this solution for 2½ seconds, only 2 cultures were contaminated after 96 hours, that is, 6.66 percent, a considerably lower figure than that obtained in either of the two previous experiments with water baths. Furthermore, though all members of the staff have been asked to watch carefully for any deleterious effects traceable to droplets of this solution being carried into

germicide No. 4 from the instruments, instead of the water bath. A fourth experiment, shown in table 3, was, therefore, carried out, to determine the time that an aqueous solution of zephiran 1/3,000 concentration would remain sterile during exposure to the air in a tray similar to that used for the water bath. Five minims of this solution was removed from the tray at intervals, as shown in the graph, and dropped into culture tubes. As long as the experiment continued, five hours, no positive results were obtained.

To reinforce the findings of this procedure, five instruments were cultured which had just been sterilized by immersion for five minutes in the germicide No. 4, and then washed off in the zephiran bath, as shown in experiment 5, table 3, allowing the bath to stand exposed for 30 minutes. Five more instruments were

similarly treated, after the bath had stood exposed for 90 minutes. As was to be expected, in both instances the cultures remained sterile.

SUMMARY

The conclusions to be drawn from the experiments reported here are, therefore:

1. Keep covers on all solutions, towels, instruments, and the like, as much as possible.

2. Substitute an aqueous solution of zephiran, or some similar detergent, for the water bath.

3. Dip all instruments that are actually to enter the eyeball into a suitable sterilizing solution, or boiling water, for at

least $2\frac{1}{2}$ seconds immediately before use.

4. Install, as soon as practicable, some method for air sterilization in the operating room.

5. Treat all blankets and sheets with some type of oil solution.

6. Treat the floor of the operating room with some type of dust-allaying preparation.

In closing, it may be of interest to note that since these investigations started, approximately 600 intraocular operations have been performed, yet only one instance of infection has occurred, and in this case the precaution of dipping the instruments immediately before use, through a misunderstanding, was not observed.

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DISCUSSION

DR. WILLIAM M. JAMES (St. Louis): Dr. Post has been interested for many years in the sterilization of the sharp instruments used in ophthalmic surgery. It is fitting that he should call our attention to the dust-borne infections and at the same time suggest methods for their control.

The value of sterile lamp irradiation and of spraying the air with triethylene vapor has been reported and will be used when air conditioning again becomes available.

The results of cultures taken by Dr. Post and Mr. Moor from surgical instruments show that the instruments were being contaminated in the uncovered

water bath. The incidence was 36 percent, before use and 77 percent after use. By dipping the instruments in either boiling water or in zephiran 1/3,000 the percentage of positive cultures was reduced to 12 percent and to 6 percent. The advantage of using an aqueous solution zephiran 1/3,000 in place of the usual water bath in sterilizing sharp instruments is shown in table 3.

Dr. Post has told me that there has been some rusting of the instruments following the use of zephiran in the water bath. The Alba Company, the producers of zephiran, state that this factor may be controlled by using 0.5-percent sodium nitrite in the zephiran solution.

DR. WILLIAM H. CRISP (Denver): I suppose everything we can do to improve the sterilization of instruments is not only justified but demanded. However, I wonder whether we do not underestimate the capacity of nature for eliminating danger from the more remote sources of infection. I have never seen anything to lead me to suppose that I picked up an infection from the air of a well-conducted operating room. Over most of my professional career, my sterilization of instruments has been done by simple immersion not in actively boiling water, but in water which has been boiling just before I use it and under which the source of heat has been cut off temporarily so that I shall not scald my hands in the process which I use. For the cataract knife, the Graefe knife, the keratome, or any other knife, I simply hold the knife for 16 to 20 seconds in the water under which the gas has just been turned off so that it is at boiling temperature but not actually boiling. I use all the rest of my instruments in the same water at boiling temperature, but no longer actively boiling, for death of bacteria comes below the boiling point. Most killing or cooking processes are accomplished well below the boiling point, so that I am not afraid of the fact that I have had the gas turned off. I believe that nearly all the inflammatory processes which we see after operation in an eye are due to some variation in surgical technique rather than to active infection. I believe the slow inflammatory processes, especially, do not arise mostly from actual infection.

If you have a foreign body on the cornea, that foreign body tends to favor bacterial development. As soon as the foreign body is removed, unless some process of infection has gone very far, the eye usually reacts very kindly toward it. The point being that any foreign material,

or any trauma, will favor bacterial infection; but that bacterial infection very generally does not develop unless the tissues have been traumatized in some unfortunate way. I do not believe any operator on the eye ever performs two successive operations in exactly the same way. There are slight variations in technique. Some of these depend upon slight variations in the anatomy of the individual eye, and I believe that the neatest possible surgery, with avoidance of undue trauma to the tissues, plays a much more important part than our extreme efforts to avoid infection. I am reminded of something I was told about the older Pagenstecher, who many years ago, before sterilization was given as much attention as it is today, always passed the cataract knife between his lips just before making the incision. He said this action made the knife go through more easily; and I do not suppose that he had a greater proportion of cases of infection after his cataract operations than most of us at present. The point here is that, under favorable conditions, the eye is extremely resistant to the threat of infection. For one thing, we have the rapid initial flow of the aqueous, which reduces the basis for bacterial development. Our main salvation lies in the simplest and most straight forward possible surgery, with proper respect to the exact anatomy of the eye of the patient we are dealing with. However, I appreciate that Dr. Post has been doing some excellent scientific work in this direction, and I very much respect what he has done.

DR. FRANCIS HEED ADLER (Philadelphia): I should like to call attention to a factor which will become more prevalent in our operating rooms, and that is the dust-borne infections due to air conditioning. In 1937, our new operating room was opened. We had no trouble from

infections until the first hot week of the summer, when the air-conditioning system was turned on. In that week I had two intraocular infections. Cultures of one of the eyes showed colonies of *Bacillus subtilis* and the contamination was traced to the air in the room, which was heavily laden with the hay bacillus. It was discovered that the air which came through the system was passing through a chamber loaded with dust and hay bacilli. Dr. Wells and Dr. Stokes have solved our problem by spraying the ducts through which the air is pumped with triethyl-glycol; since then we have had no further infections.

DR. ARTHUR M. YUDKIN, (New Haven): It is evident from the investigation of Post that dust-borne infection is of great importance in ophthalmic surgery. Although I have not encountered many postoperative infections of the orbital tissue in muscle operations, cataract extractions, operations for glaucoma, or detachment of the retina, I know that some ophthalmic surgeons have been concerned about the frequency of postoperative infections. From 1939 to 1945, when it was most difficult to obtain well-trained assistants in the operating room and the operating teams were overworked, we were free from postoperative infections. It was not unusual for an eye operation to follow an abdominal operation, yet with ordinary care no infections of the ocular tissue were observed.

It is a miracle why more infections are not encountered postoperatively in ophthalmic surgery, for the conjunctiva cannot be sterilized properly, and it is extremely difficult to free the air from air-borne infection. We observe the same operating room technique employed by the general surgeon. The noncutting instruments, towels, gowns, basins, dropper

bottles, and table covering are autoclaved under pressure. The medication is sterilized by the drug department daily. The cutting instruments are placed in Post's original sterilizing solution for 5 to 10 minutes.

Post's recommendation of a system of lamps to sterilize the air-borne infection is commendable, and I believe the operating room of the future will be air conditioned and constructed so the air can be sterilized. Not only should the floor of the operating room be prepared with a dust-allaying preparation but the whole operating suite should be protected. The clothing of the operator and assistants should also be considered as a source of contamination. I am satisfied that too many precautions cannot be taken to make an operating field free from extraneous infection. It is important that the operating team and the patient be comfortable in this ideally constructed operating suite of the future.

DR. M. HAYWARD POST (closing):

I agree with Dr. Crisp, and realize the truth of his remarks. Our experiments have demonstrated that the eye has a tremendous capacity to fight infection. They show that, though we had 77.77 percent of contamination at the close of operation, yet the hospital records in the past have shown relatively few infections, about one tenth of 1 percent, with approximately 600 intraocular operations performed annually. However, if we can reduce that percentage to nothing, we are making a definite advance. I might also cite in this connection, the experience we had when Colonel Smith demonstrated his intracapsular operation for us on 42 cataracts in one afternoon. During those operations, he smoked no less than four cigars; there were various complications, but no infections.

I attribute the lack of infection at the hands of the older operators to the fact that they were careful not to touch the tips of their instruments, and that they used fewer instruments; consequently, each one could be laid back carefully, so that its tip was not touching anything that might cause contamination.

As to Dr. Adler's remarks, I would say that I have read merely an abstract of my paper. In the complete paper, air sterilization by triethylene glycoll and ultraviolet is discussed, and ways suggested in which they may be used with safety. Much has still to be done on that subject before the answer is known.

NOTES, CASES, INSTRUMENTS

VENOUS PULSATION AS A SYMPTOM OF EARLY GLAUCOMA*

SAMUEL ENGEL, M.D.

San Francisco

The phenomenon of pulsation of the retinal vessels is usually looked upon as only a curiosity without much clinical significance. Arterial pulsation is present in glaucoma at a pressure of about 60 mm. Hg (Schiotz). The artery is compressed in diastole, while the vessel is still able to fill in systole, at which time the arterial pressure is slightly higher than the intraocular pressure. Among medical diseases, arterial pulsation is found in aortic insufficiency as a manifestation of the increased pulse-volume, and in Graves's disease.

Venous pulsation as a physiologic phenomenon can be seen in a considerable number of patients, particularly in children. It is due to the fact that the venous pressure is about equal to the intraocular pressure, and the increased filling of the choroidal arteries in systole raises the intraocular pressure just enough to compress the vein, which dilates again in diastole. The appearance of venous pulsation depends, therefore, on the intraocular pressure and on pressure in the vein. In the majority of patients, it can be brought about by increasing the intraoc-

ular pressure by pressing slightly on the eyeball. When the pressure is further increased, venous pulsation may be present even together with arterial pulsation.

Increased intracranial pressure, by compressing the vein in the subarachnoid space surrounding the optic nerve, causes stasis in the retinal veins and so raises the pressure in the veins. Absence of venous pulsation is, therefore, an early sign of papilledema. Manz (1874) and Laqueur (1877) observed that venous pulsation is usually lacking in "inflammation of the meninges" with marked venous hyperemia of the retina (cited by Leber¹). In neurologic patients suspected of cerebral disease, I am inclined to regard the presence of venous pulsation as a sign which makes increased intracranial tension highly improbable, a fact also stressed by Baurmann.²

While examining several patients for refraction or because of slight discomfort, I was impressed to observe marked venous pulsation in one eye which was not, or only to a lesser degree, present in the other eye. The pulsation had a slightly different character from the type usually seen. It was more "jumpy;" the constriction was more marked; and the filling more rapid. When taking the tension of such an eye, I found an increased intraocular pressure in many cases. Physiologic variations in the appearance of the venous pulsation were present, and

*From the Department of Ophthalmology, Stanford University Medical School.

I did not find increased tension in all suspected cases. However, those which showed an increase in tension might have been overlooked if my attention had not been attracted by the pulse phenomenon.

CASE REPORTS

Short reports of three histories follow:

Case 1. Dr. S. K. D., aged 60 years, came to me in February, 1943, because he felt a slight pain in the right eye when coming from the light into the dark, also after lighting a match in the dark. Examination showed vision to be: O.D., with a +1.25D. sph., 20/15; O.S., with a +1.50D. sph., 20/25. The left eye had always been the poorer eye. The pupil of the right eye was slightly larger than that of the left; the anterior chamber deep. There were two tiny precipitates on Descemet's membrane. The discs were normal, but showed a marked venous pulsation, with the aforescribed "jumping" characteristics in the right eye. There was a slight venous pulsation in the left eye. The intraocular pressure was 40 mm. Hg (Schiotz) in the right eye; 20 mm. in the left.

A diagnosis of serous iridocyclitis, with increased intraocular pressure, was made, and the right eye treated with mild mydriatic drops. The tension dropped slowly to 23 mm., and the pulse phenomenon decreased in intensity until it was the same as in the left eye.

When the patient had a similar attack in October, 1943, the degree of venous pulsation made it possible to assume approximately a rise or fall in tension, which was confirmed by the tonometer.

Case 2. Mr. A. W. E., aged 72 years, was seen in October, 1944, for refraction. Examination disclosed vision to be: O.D., with a -1.00D. sph. \subset 1.50D. cyl. ax. 15°, 20/40; O.S., with a 1.25D. cyl. ax. 165°, 20/15. (Vision in the right eye

had always been impaired.) The iris of the right eye showed a small peripheral coloboma at the 5-o'clock position and some fine posterior pigment synechiae. Gonioscopy revealed that a small tissue stump had been left peripheral to the coloboma and that there were anterior peripheral synechiae on both sides of the coloboma. As the patient had never had his eyes operated on, this condition was assumed to be a coloboma after early inflammation of the iris.

The pupils reacted to light, although slightly irregularly in the right eye. The discs were normal. The vessels of the right eye showed slight bending, which could have been regarded as within physiologic limits. But the central vein of the right eye had a strongly accentuated pulsation, whereas the pulsation in the left eye was just visible. The tonometer registered a tension of 33 mm. Hg (Schiotz) in the right eye; 23 mm., in the left.

Under treatment (2-percent solution of pilocarpine), the tension of the right eye dropped to normal, and the difference of pulsation between the two eyes disappeared.

Case 3. Mr. W. L., aged 42 years, on a visit to California, came to see me in October, 1945. The day before he had had an attack of cloudiness over the right eye after an afternoon's exposure to sunlight. For the past year, he had experienced similar attacks, but of lesser degree, two or three times monthly. Ten years before, holelike changes of oval form in both maculas (from solar radiation?) had been observed. This had impaired his vision as follows: O.D., with a -4.00D. sph. \subset -0.50D. cyl. ax. 90°, 20/25; O.S., with a -0.50D. cyl. ax. 90°, 20/30.

The right eye, whose anterior chamber was deep, showed neither corneal edema nor precipitates. Both discs were normal. A venous pulsation, "jumpy" in char-

acter, corresponded to a tension of 42 mm. Hg (Schiotz), which decreased to 26 mm. under pilocarpine treatment. Tension in the left eye had always been normal.

On a search through the literature only one reference was found, that of Troncoso, who mentioned, as an ophthalmoscopic symptom of glaucoma, that: "the veins frequently show spontaneous pul-

sation." It would, therefore, seem worthwhile to draw attention to the fact that a *difference* of venous pulsation in the two eyes, particularly if "jumpy" in character, may be a sign of an early glaucoma that does not yet show marked clinical symptoms and should induce the physician, if for no other reason, to test ocular tension.

350 Post Street (8).

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CORNEAL INSULT FROM PODOPHYLLIN

ROBERT S. ROSNER, M.D.
Cleveland

Ophthalmologists must constantly advise doctors against treating skin conditions around the eye as they would elsewhere on the body. The following case points out that doctors have yet to learn this simple dictum.

A practitioner of medicine treated a patient for "warts around the left eye" with a 25-percent solution of oleoresin podophyllin in mineral oil. He stated that this medication was used for the removal of warts in other regions of the body with good results.

REPORT OF A CASE

A white man aged 52 years, in good general health except for a rectal condition for which he consulted his doctor, was advised by the same doctor to have some warts removed from the region of his left eye for cosmetic reasons. The patient was given a prescription for 25-percent oleoresin podophyllin in mineral

oil to be applied nightly with a glass rod to the affected parts. On January 27, 1946, the patient applied this medication to the areas as instructed. No ill effects resulted from the first application. The following night his son applied the medicine to the parts with a glass rod. The patient went to bed soon after, and, during the night, his nose "ran like water," and his left eye smarted and itched. He said that he had not been conscious of any seepage of the medication into the eye but felt that this must have occurred while he slept. Twice during that night he awakened because of some discomfort around the left eye. The next morning the left eye was "all red and puffed up." Some discomfort was present, but no severe pain. He was able to stay on his job by squinting and keeping the left eye closed. When the eye was opened, he felt some pain. He consulted the practitioner on January 29th, because the pain grew progressively worse. An analgesic ointment was instilled, and the eye bandaged. The doctor instilled more ointment on the following morning. The patient then became aware that vision in the involved eye was

extremely blurred, although the pain had somewhat abated. He was sent to the writer for consultation on January 31, 1946.

OPHTHALMOLOGIC EXAMINATION

Visual acuity was 6/6 in the right eye, and 1/60 in the left eye. On the skin of the temporal half of the lower lid of the left eye were multiple small papillomatous growths; a few were on the upper lid also. There was dryness and excoriation of the skin around the outer canthus. Moderate photophobia was present. The bulbar and palpebral conjunctivas were congested and edematous. Ciliary venous congestion was marked. There were considerable lacrimation and some bhepharospasm, which were somewhat relieved by the instillation of a 0.5-percent solution of pontocaine. A 2-percent solution of fluorescein was applied, followed by another drop of pontocaine. An irregular rounded corneal ulcer took the stain. This ulcerated area, located directly at the center of the cornea, was about 4 mm. in its widest diameter. There were also two other tiny ulcers near the limbus, one at the 11-o'clock, and the other at the 5-o'clock position. The entire corneal epithelium was strikingly hazy and lusterless (see figure 1).

Slitlamp examination. The edema of the epithelium was seen chiefly by retroillumination. It had the appearance of tiny globules of varying sizes. The ulcer, disciform in appearance, was superficial, amounting only to a loss of surface epithelium. No erosions were present in Bowman's zone, and there was no corneal vascularization. The vascular plexuses at the limbus were greatly congested. Many tiny, rounded spots of infiltration in the corneal stroma extended down to Descemet's zone. The most remarkable finding was that Descemet's membrane was wrinkled throughout the

entire posterior corneal surface. No keratic precipitates were present. There was a one-plus aqueous ray, but it was assumed that this was caused by diffraction of light by the translucent and hazy cornea. Even with the use of a high-power lens, no cells were seen in the anterior



Fig. 1 (Rosner). Corneal lesion as the result of the use of oleoresin podophyllin in the region of the eye.

chamber. However, it was difficult to penetrate the corneal haze. The iris showed no involvement.

Ophthalmoscopic examination. Only a red reflex could be obtained in the left eye. No details whatever were visible. The right eye was entirely normal. A 3-percent solution of homatropine was instilled into the left eye. This was followed by the application of holocaine-epinephrine ointment and an eye pad. The patient was observed daily. On the third day, the ulcer had healed, and the area did not take the fluorescein stain. Vision had improved to 4/60. Although the pain had subsided

completely, one could not obtain a view of the fundus. Descemet's membrane was still wrinkled in a peculiar wire-screen or checker-board fashion which was most noticeable near the center of the cornea. The corneal periphery was clearing well. Even though the anterior chamber was not entirely clear, there was no aqueous flare. High-power examination failed to reveal any cells. Treatment consisted of frequent instillations of sterile olive oil. The eye pad was removed. On February 8th, the cornea had cleared sufficiently for the patient to be able to read the 6/9 line. However, even though they were fading, the criss-cross folds in Descemet's membrane could still be seen.

OUTCOME

Not until one month after the onset of this disturbance did the eye become totally quiet. Grossly, one could see a faint, nebulous scar at the center of the cornea.

Vision in the left eye was corrected to 6/7.5-2. Slitlamp examination revealed that the wrinkles in Descemet's membrane had disappeared completely. The nebulous region was carefully studied. It consisted of extremely fine, silvery dots and spots scattered throughout the substantia propria of the cornea. Bowman's and Descemet's zones were not involved in this process. A good fundus view was obtained, and the fundus was entirely normal.

CONCLUSION

A case of corneal insult from oleoresin podophyllin has been presented. One cannot help but marvel at the recuperative powers of the cornea. Despite this fact, ophthalmologists should warn the general practitioner of medicine to treat skin conditions around the eye with utmost caution.

707 Rose Building (15).

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

November 5, 1945

DR. PERCY FRIDENBERG, *presiding*

IONTOPHORESIS IN OPHTHALMOLOGY

DR. LUDWIG VON SALLMANN presented a paper on this subject during the instructional hour.

GENERAL ANESTHESIA IN OPHTHALMIC SURGERY

DR. MORRIS BIEN gave a report on this subject which has been published in this Journal (September, 1946).

Discussion. Dr. James W. Smith said that some slips in technique are seen in the general hospital which nullify the anesthetist's efforts. Preoperative orders for children are not always followed, and the operation may be interrupted by vomiting of orange juice or food given before operation, usually by a comrade. He said that he has observed marked cyanosis in children after operation when the nurses failed to remove the endotracheal airway. When pentothal anesthesia is employed, adequate local anesthesia must be used because there may be pain, especially in muscle surgery.

Dr. Joseph J. Fried described a case in which pentothal was used for an iridectomy. When the iris was grasped, the patient sat up and sneezed; this was repeated after a few minutes wait. Another patient, given pentothal for an enucleation, remained unconscious for three days. The diagnosis was respiratory depression from the anesthesia. Within a few days, a fatal hypostatic pneumonia developed.

Dr. Benjamin Esterman inquired about the dosage of atropine as premedication for ether anesthesia.

Dr. Bien said that he has experienced the same difficulties which Dr. Smith described. He avoids very deep anesthesia in children, tries to anticipate the end of the operation, and stops the anesthesia early so that, by the time the eye is dressed, the reflexes are returning and the airway can be removed in the operating room.

The average dose of atropine for an adult is 1/150 gr. However, the dose varies with the patient. A 16-year-old patient would receive 1/200 gr. together with 1/8 gr. of morphine.

The best time for administration is one hour before operation when given in conjunction with an opiate, and one-half hour before if given alone.

LOCAL ANESTHESIA IN OPHTHALMOLOGY

DR. WALTER S. ATKINSON attributes many operative accidents to forcible contraction of the orbicularis or to failure of the patient to hold well because of incomplete anesthesia. Many cases of vitreous loss are due to poor anesthesia and, if more than one percent of uncomplicated cases lose vitreous, the anesthesia procedure should be checked.

A patient's confidence is an important factor which sedatives aid in achieving, but sometimes sedatives produce excitement, nausea, or vomiting. Administering them the night before operation will indicate the patients who react adversely. For preoperative use, phenobarbital or pentobarbital, 1.5 gr. or more, with aspirin, 5 gr. (the latter apparently has a synergistic action), is effective. Tetracaine (pontocaine) 0.5 percent is the most suitable of the surface anesthetics. Procaine (2 percent with 1 drop of epinephrine 1:10,000 to 5 c.c.) is also effective. The epinephrine is raised to 4 drops for

retrobulbar anesthesia when it is desirable to lower intraocular pressure. A luer-lock syringe is the most satisfactory type. Needles recommended are: no. 27 (12.5 mm.) for subcutaneous use; no. 25 (2 cm.) for akinesia and deeper subcutaneous injection; and no. 22 (3.5 cm.) for retrobulbar and deep injection.

The O'Brien lid block seems more efficient than the Van Lint. In performing this, have the patient open his mouth to permit identification of the condyloid process, introduce the needle almost to it, inject a few drops, advance to the process and inject 2 to 3 c.c. If akinesia does not take place in a few minutes, another injection is indicated.

It is advisable to produce a dermal wheal prior to retrobulbar injection which should be done with a 3.5 cm. needle having a rounded point. If the patient looks up and away from the site of injection, the fascial connection of the muscles will be drawn away. As long as the needle is within the muscle cone, anesthesia will be satisfactory because the solution diffuses throughout the fatty tissue. For operation on the globe, 1 to 1.5 c.c. is injected, and 3 c.c. for enucleation or muscle operations. This will block the sensory nerves and produce paresis of the rectus muscles which reduces the likelihood of squeezing. The anterior chamber will be deeper; the lens capsule will be looser; and the possibility of vitreous loss will be diminished. Concurrent instillation anesthesia is required since only the conjunctiva about the cornea is anesthetized. Retrobulbar anesthesia is also useful in lowering pressure and relieving pain in acute glaucoma.

For lacrimal sac operations, the infra-trochlear nerve is blocked by inserting the needle to a depth of 3 cm. at the upper-nasal angle of the orbit. Another 0.5 c.c. is injected at the supra-orbital notch. To produce anesthesia of the duct and lower sac, the infra-orbital nerve is blocked by

inserting the needle in the canal, which is 1 cm. from the ala of the nose, and injecting 1 to 2 c.c. If there is no foramen, or if it is missed, the injection is made at the infra-orbital fissure.

Tumors of the lid are removed under infiltration anesthesia except in cases when they are so large that they require block anesthesia. This is produced by injecting along the orbital margin, carrying the needle close to the bone to beyond the horizontal borders of the lid.

Discussion. Dr. Max Kimbrig described one case in which the pupils dilated after the use of tetracaine. He thought there had been some error made and reinstalled the drug at a later date with pupillary dilatation again taking place.

Dr. Harvey Thorpe said that occasionally patients will be given tetracaine for treatment of corneal ulcers or other conditions. Sometimes the eye becomes sensitive to this drug, and a corneal ulcer develops which takes many weeks to heal. He considers the retrobulbar injection of novocain of great value as it softens the globe and minimizes vitreous loss. The needle should be examined before use. A damaged point may tear an orbital venule and result in retrobulbar hemorrhage. Placing the finger between the globe and lower orbital margin, thereby pushing the eye upward, facilitates the passage of the needle behind the globe.

Dr. Atkinson stated he had never seen a case of dilatation of the pupil with tetracaine.

PHARMACOLOGY OF OPHTHALMIC DRUGS

DR. WALTER MODELL stated that the conjunctiva are excellent absorbing surfaces. Lowering the surface tension speeds their absorption. The wetting agents or detergents which accomplish this often are quite irritating, but the aerosols and zephiran, in proper concentration, can be used safely. The closer the

osmotic tension to isotonicity with the tears, the more rapid the absorption. Tables indicate the amount of salt required for various drugs. Most ophthalmic drugs can be buffered to slight alkalinity at which they are absorbed best by the conjunctiva. The closer alkalinity is to pH 7.5, the less is the irritation.

The sulfonamides and penicillin have resulted in new standards of antibacterial effectiveness. A chemical antiseptic, by definition, retards the development of disease-producing bacteria in vitro, but the in-vitro characteristics have no bearing at all on an antiseptic's usefulness in treating infections on the surface of the eye or in the body, and some interfere with the body's normal anti-infective actions. They may be mutually antagonistic with the lysozyme of the tears, vitiating the antibacterial properties of each other. In general, sterile wounds heal more rapidly if antiseptics are not applied and, in infected wounds, strong chemicals seem to retard the eradication of bacteria. It is doubtful if local infections in the eye are exceptions to this rule.

Experience has shown that the local use of sulfonamides is not as effective as originally believed. All evidence indicates that they work from the interior of the cell and not as surface-acting materials.

Penicillin is surface active and well-absorbed by the eye. It is effective by injection and orally but about five times as much must be taken by mouth for effects equivalent to those produced by intramuscular injection. The blood level must be maintained continuously as peaks represent wasted penicillin.

Ophthalmology has, perhaps longer than any other branch of medicine, made use of drugs acting on the vegetative nervous system. The choline group is one of the recent parasympathetic-affecting additions to this list of drugs. Their action in the eye simulates stimulation of the

oculomotor nerve which normally functions by elaboration at the nerve ending of acetylcholine which in turn is destroyed by cholinesterase. Acetylcholine is too quickly destroyed to be useful clinically. Mecholyl, its betamethyl derivative, is much more slowly destroyed and is clinically valuable. Doryl, called carbachol for ophthalmic use, is carbaminoylcholine, and is not destroyed at all by esterase. Its absorption, when instilled in the eye, is enhanced by a wetting agent, for which zephiran is usually recommended.

Physostigmine and prostigmine produce their parasympathetic effect by destroying esterase and permitting the accumulation of the acetylcholine. When administered together, they similarly protect mecholyl.

A new derivative of carbachol, called dibutoline, introduced by Swan, has an increased surface activity and is well-absorbed by the eye. Surprisingly, its action is similar to atropine, being a mydriatic and a profoundly rapid acting cycloplegic. It is antiseptic, as are all wetting agents. The best explanation for its reversal in action is that it is actually inactive but that it is so similar, chemically, to acetylcholine that the body does not discriminate between the two. If enough is present, it displaces the normally formed acetylcholine and prevents its action.

Discussion. Dr. Fredrick H. Theodore said that he thought Dr. Modell felt that the sulfa drugs were not effective when applied locally to the eyes. He described well-controlled cases which showed the contrary: (1) An occlusion body conjunctivitis that had not been treated for one month. Local sulfa treatment resulted in complete disappearance of clinical symptoms and signs in three days. (2) An acute staphylococcus conjunctivitis which cleared up with the local use of sulfonamides alone. Dr. Theodore also remarked on the great frequency of aller-

gic reactions produced by penicillin ointment.

Dr. Adolph Posner pointed out that pilocarpine has been a standby for many years. Only recently have the choline derivatives become popular. With Dr. Mark Schoenberg he developed some criteria regarding their use. It seemed to him that prostigmine or doryl are no better than pilocarpine and probably less reliable in chronic glaucoma. Their effect probably depends on the state of the parasympathetic system at the time of use.

Dr. Modell said he did not question that sulfonamides used locally are effective in the treatment of some infections of the eye. He questioned, however, whether the local use of the drug is superior to adequate oral administration.

Regarding reactions to penicillin, he said that all such reactions may not be due to the penicillin itself. About 50 percent of the parenteral penicillin preparations now on the market have impurities which may be to blame. However, there is reason to believe that, in some cases, pure crystalline penicillin also produces reaction.

Pilocarpine acts to produce parasympathetic effects much like those produced after the administration of physostigmine. It acts directly, however, and not, as does the physostigmine, through an intermediary acetylcholine. Since pilocarpine is more independent in its action than physostigmine, it seems reasonable to suggest that there may be situations in which pilocarpine would produce satisfactory effects while physostigmine or prostigmine would fail.

RECENT PROGRESS IN OPHTHALMIC THERAPY

DR. JAMES W. SMITH said penicillin is the drug of choice, and effects a more rapid cure than the sulfonamides in the

treatment of gonorrheal ophthalmia, penetrating injuries, orbital cellulitis, and ulcerative keratitis. The organisms most sensitive to penicillin are beta-hemolytic streptococci, gonococci, streptococci viridans (alpha), streptococci anhemolyticus (gamma), and some strains of staphylococci.

Penicillin may be applied locally by instillation (500 to 10,000 Ox. u. dissolved in 1 c.c. isotonic sodium chloride or distilled water, pH 7.7), conjunctival pack (20,000 Ox. u. per c.c. concentration), ointment (1,000 Ox. u. per gm.) intramuscularly, intravenously, or orally (calcium-penicillin tablets 20 to 25,000 Ox. u.). Intraocular infections of the anterior segment after penetrating wounds can be treated by withdrawal of 0.25 c.c. of aqueous and replacement by penicillin solution (1,000 Ox. u. per c.c.).

The clinical disorders responding to the sulfonamides are trachoma, inclusion conjunctivitis, lymphogranuloma venereum, gonorrheal ophthalmia, streptococcal corneal ulcer, bacillus pyocyaneus ulcer, erysipelas, impetigo of the lids, and staphylococcal blepharoconjunctivitis.

Sulfathiazole and sulfadiazine penetrate poorly through the cornea. The wetting agents, by lowering interfacial tension, increase the concentration of these drugs in the aqueous humor and make them effective for treating anterior segment infections. Aerozol-os (0.5 percent) is a nonirritating detergent.

Iontophoresis, combined with oral and topical application of the sulfonamides will produce maximum concentration in the cornea, aqueous, and anterior uvea in treating extensive corneal ulcer, endophthalmitis, and panophthalmitis.

Mecholyl, neostigmine bromide (prostigmine), and carcholin (originally marketed as doryl) have added greatly to the medical treatment of glaucoma. Mecholyl

chloride, 10 percent, with prostigmine, 3 percent, is an excellent miotic for patients with chronic simple glaucoma that cannot be controlled with pilocarpine and eserine. For acute congestive glaucoma, inject morphine sulphate (0.25 gr.) and instill mecholyl, 20 percent, and prostigmine, 5 percent (1 drop every 10 minutes for 7 doses). If intraocular pressure is not reduced after 1½ hours, give a retrobulbar injection (25 mg. of mecholyl in 1 c.c. procaine, 2 percent). The antidote, if necessary, is atropine 1 to 2 mg. Continue mecholyl and prostigmine drops for five additional doses. These drops are also recommended as a collyrium every 10 minutes for 1 to 2 hours, preoperatively, to reduce intraocular pressure.

Carcholin is valuable as a "rest therapy," after which the patient may be more responsive to the use of the usual miotics. In a 0.75 percent concentration, it is less irritating than pilocarpine and eserine and does not produce allergic dermatitis or conjunctivitis. Carcholin drops are not surface active. Vigorous massage for two minutes after instillation is necessary to increase absorption and the drug's effectiveness.

Dr. Smith stated that the extravagant claims made for vitamins in ophthalmic therapy have not been substantiated. He prescribes vitamin A for old, feeble patients with recurrent catarrhal ulcers, keratoconjunctivitis sicca, and mild forms of epithelial dystrophy. Vitamin B and B complex are effective in toxic amblyopia and retrobulbar neuritis. Vitamin B₂ is effective in rosacea keratitis. Vitamin D, in combination with vitamin A, is helpful for phlyctenulosis and severe blepharitis in children. Dr. Smith questioned the efficacy of vitamin C. The indications for vitamins K and P are limited. Considerable progress has been made in decreasing the irritation of eye drops and

improving their effectiveness by the use of solutions isotonic with tears, by standardization of the pH, and by the use of buffer solutions.

The detergents or "wetting agents" have been shown to accelerate the absorption of drugs like carcholin and the sulfonamides, but unfortunately these agents have an irritating and deleterious effect on corneal epithelium. Detergents should not be used in eyes with corneal abrasions.

Dr. Smith referred briefly to dibutoline sulfate, the newly described surface-active mydriatic and cycloplegic, which can be used safely in patients sensitive to the atropine drugs.

Leon H. Ehrlich,
Secretary.

COLORADO OPHTHALMOLOGICAL SOCIETY

November 17, 1945

DR. WALTER OHMART, *president*

DRUSEN OF THE OPTIC DISC

DR. WILLIAM M. BANE reported on Mrs. R. H. C., a 38-year-old white woman with general good health. She noticed, six years ago, that the pupil of the right eye was dilated. No cause was found. She was seen by Dr. Riche at that time. Neurologic findings were negative. There was no history of injury. Glasses were ordered 5 years ago, by an optician. Examination: R.E., 5/20; L.E., 5/20. The media were normal. Refraction was performed and glasses were ordered for myopia giving vision of 5/4 in each eye. Each disc was partially covered with excrescences which are called drusen.

According to Duke-Elder, drusen are really hyaline bodies made up of concentric laminations with no cellular structure nor capsule. They are supposed to be de-

rived, as is Bruch's membrane, from pigimentary epithelium displaced into the disc. Fuchs says they are of neural origin.

The appearance varies from flat masses to grapelike elevated clusters. They are located at the edge, center, or completely covering the disc. The condition is usually bilateral and may be associated with similar formations in the macula or elsewhere. It occurs in all ages but is most common in the aged and in the presence of retinal disease. If pressure on nerve fibers occur, there may be some atrophy and field changes.

ANIRIDIA OR IRIDEREMIA

DR. WILLIAM M. BANE reported on the case of a white boy, aged five years. This boy was seen several months ago at the clinic. Both eyes were similar, exhibiting the typical picture of aniridia, a rare congenital defect in which the iris is not completely absent but only a short rudimentary stump can be observed, hidden behind the cornea-scleral margin. The pupil occupies the whole area of the cornea, and the margin of the lens, the zonular fibers, and the summit of the ciliary processes may be observed. In this case, the lens margins were flattened at the six-o'clock position, indicating, here, a contraction of the capsule where the zonular fibers had probably ruptured. The boy exhibited no evidence of poor vision, and had no nystagmus nor photophobia, which so often accompanies this condition. The anterior chambers were normal in depth, and the lenses were neither ectopic nor cataractous. The history of heredity in this case was negative.

Discussion. Dr. Fritz Nelson and Dr. John Long suggested the tattooing of an iris on the cornea. Dr. W. T. Brinton mentioned a case of traumatic aniridia in which the eye was not sensitive to light. Dr. Morris Kaplan suggested colored contact lenses.

MEDULLATED NERVE FIBERS

DR. WILLIAM M. BANE reported on Mr. C. M. S., age 42 years. His condition, of opaque nerve fibers of marked degree which almost surrounded the disc of the left eye, was shown to illustrate the fact that elevation sometimes is noted. In this case, it measured about 2D. and could be distinctly observed by parallax. Medullated nerve fibers are not observed in the newborn, but develop after birth, and, therefore, are not considered congenital.

MALIGNANT MELANOMA

DR. R. W. DANIELSON presented a report of two cases.

Case 1. J. T. S., a 32-year-old man, who had been seen first in November, 1942, because of cloudiness of vision of the left eye, of two-weeks' duration. Vision was: L.E., 20/20; R.E., 20/15. No lesion of the media or fundus could be found, and the peripheral field was normal although there was a questionable enlargement of the blind spot. He was treated with typhoid vaccine, but by July, 1943, vision was 20/25.

In August, 1944, a faint, dark, choroidal elevation above the left macula was first noted. Vision was 20/25, but no central-field defect could be found corresponding to the lesion. However, by June, 1945, there was a small scotoma near fixation which had enlarged considerably by October, 1945.

At the time of presentation, vision was 20/40. The elevation had increased 1D. in five months. Tension was 20 mm. Hg (Gradle-Schiøtz). There were a few punctated hemorrhages in the retina, especially over the elevation. General examination had revealed no abnormality elsewhere. No foci of infection were found, and the Kahn test was negative. No melanin was present in the urine. The patient was presented for opinions as to the advisability of enucleation.

Dr. Danielson said that no transillumination had as yet been tried because of the scotoma's location but that even if some shadow did show, it would not prove a melanoma. In fact, as was pointed out, there is, as yet, no positive test or manner of examination by which a differential diagnosis between an early melanoma and other lesions of the choroid can be made. It was mentioned that it seemed somewhat ironic to have means of analyzing the composition of stars millions of miles away by spectroscopy, but no way of telling the composition of a structure close at hand. It was thought that someday there might be a device, like radar perhaps, whereby reflected rays might give an inkling as to the content of a tumor. In the absence of such an imaginary device, it was hoped that X ray might be sufficiently refined so that it would help in diagnosis and that the path to progress would lead to the finding of some chemical which, when injected intravenously, would have a selective affinity for melanin and would be radiopaque. If such a chemical could be found, it would also be of value in searching for possible metastases. Perhaps melanin so treated might be mixed in vitro, be injected and be found to have selective affinity for a melanotic tumor which ordinarily produces melanin.

Case 2. Dr. R. W. Danielson also presented R. M. A., a 69-year-old man, who had noticed a progressive loss of vision in his right eye for about a year. He had had no pain or inflammation in the eye. On examination, a large, brownish-black, pigmented mass was found hanging from the ciliary body and anterior choroid superiorly. Tension was 11 mm. Hg (Gradle-Schiotz). The peripheral field showed generalized contraction rather than an inferior defect, as one would expect. The fundus was normal except in the region of the elevation. The affected

area transilluminated very poorly. An interesting feature was the presence of an opacity of the lens capsule near the tumor, similar to the case shown by Dr. Fritz Nelson at the last meeting.

After reviewing some recent literature, Dr. Danielson pointed out the high incidence of death, even when the eye had been removed quite early. He conjectured the possibility that these tumors tend to metastasize in their incipiency, rather than later when, perhaps, some reactive mechanism tends to bind the tumor cells in place. He wondered whether the opacity in the lens is due to pressure, to some toxic action, or to an involvement of the ciliary nerves supplying that part of the eyeball, since malignant melanomata are now thought to have their genesis in neural elements.

MARCUS GUNN SYNDROME

Dr. JOHN C. LONG presented the case of J. A. S., a five-year-old boy with a Marcus Gunn syndrome. The boy showed a marked ptosis of the left upper lid. The left lid opened widely when the jaw was opened; especially when the jaw was thrust to the right. Opening of the left lids was much less pronounced when the jaw was thrust to the left. On chewing, there was a rhythmic raising and lowering of the left upper lid. This condition was somewhat more pronounced when the eyes were turned downward. There was also a paralysis of the left superior rectus muscle. The defect had been present since birth.

HERPES ZOSTER

Dr. MUIR presented E. H., a white man, aged 76 years. In May, 1945, he had an eruption which, on the right, followed the distribution of the Vth nerve. This eruption was accompanied by pain. When he was seen in the clinic at Grand Junction, June 6, 1945, the eruption was near-

ly gone, but the pain persisted. The patient also complained of diplopia.

Three 5,000-unit dosages of diphtheria antitoxin were given. Four Kahn tests were: (1) positive, (2) positive, (3) doubtful, (4) negative. Spinal test was negative. He was also given alcohol and cocaine injections into the medial aspect of the right eyebrow, which only made the pain worse.

Seen at the Colorado General Hospital for the first time on October 21, 1945, he was referred to dermatology, where he was given six injections (2 c.c. each) of thiamin over a 12-day period. Since the patient still complained of pain, cobra venom treatments were started on November 15, 1945.

Examination at the eye clinic revealed: On November 2, 1945, asymptomatic. Vision was R.E., 20/100; L.E., 20/30, plus. The patient said that ptosis was disappearing, and that there had been no diplopia for a long time. Pain returned on November 13th. The cornea of the right eye showed diffuse, generalized, superficial, punctate staining areas. On November 15th, only the inferior portion now stained. At present the residuals of herpes zoster ophthalmicus are present on the right forehead and eyelid, especially on the palpebral conjunctiva. Both the ptosis and diplopia were transient. Corneal staining recurred after an interval in which the patient was free of ocular symptoms.

Discussion. Dr. Katherine Chapman suggested the injection of pituitary and the local application of collidum. Dr. J. Shields advised the use of penicillin, locally, and Dr. J. Long suggested the use of convalescence serum.

Gertrude Hausmann,
Secretary.

CHICAGO OPHTHALMOLOGICAL SOCIETY

November 19, 1945

PETER C. KRONFELD, *president*

CLINICAL PROGRAM

(Presented by the Department of Ophthalmology, University of Illinois Medical School)

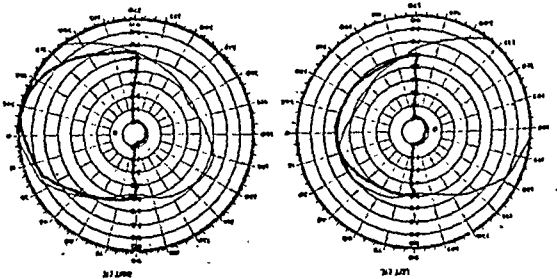
SPASTIC DIPLEGIA WITH HOMONYMOUS HEMIANOPIA

DR. EDWARD J. HORICK said that C. R., a woman, aged 33 years, complained that her eyes tired quickly with near vision. Refraction showed a -3.00 sphere in each eye and a divergence excess, 26 degrees for near. Exercises helped considerably, and she is now comfortable with near work.

Visual field study showed a homonymous hemianopia with sparing of the fixation area. She had been unaware of the defect. The neurologic report was antenatal disease of the brain. The condition may be regarded as a variation of Little's disease.

GROUPED PIGMENTATION OF THE RETINA

DR. STEPHEN W. SUKUMLYN presented M. L., a white boy, aged 17 years, who was referred from the Department of



Pediatrics and Endocrinology where he was studied for obesity. Laboratory tests were negative. External examination of the eyes was negative. Visual acuity was:

R.E., 1.5-2; L.E., 1.5-3. He had never worn glasses.

Examination of the fundi after homatropine refraction revealed normal papillae and normal retinal vessels. The immediate area surrounding the discs and extending to the temporal side to include the macular region was of normal orange color. In the right eye, toward the nasal side, there were numerous various-sized dots, spheres, ovals, and other irregularly shaped, sharply defined spots of pigmentation gradually increasing in number as they receded from the disc toward the equator. The pattern had a tendency to run in groups, the groups forming a congestion which followed the equator of the eye, becoming more scant on the temporal side. The picture in the left eye was similar, although less striking. The pigment ranged in intensity from light to dark gray, and its position in the retina was below the retinal vessels and above those of the choroid.

Peripheral fields were normal for red, white, and blue; central fields showed no scotomata.

This is a typical case of group pigmentation of the retina. It has normal visual acuity, normal central and peripheral fields, and an abundance of pigmentary plaques in the retina. Comparatively few cases have been recorded in the literature, under various names such as: melanosis of the retina, group pigmentation of the retina; nevoid pigmentation of the fundus, and congenital melanosis of the retina. The explanation of the position of the pigment as given by Ida Mann is "an atypical differentiation of isolated cells of the inner wall of the cup, each of which has developed pigment and then divided to form the small clump of cells seen in the pigmented spot." Parsons, after microscopic examination of such an eye in 1904, explains the plaques as aggregations of deeply pigmented cells of

retinal epithelium which found their way into the layers of the retina through spaces where rods and cones had failed to develop.

BILATERAL EXTERNAL RECTUS PARALYSIS (CONGENITAL)

DR. ROOSEVELT BROOKS said that D. V., aged 17 months, was first seen in September, 1944. The mother stated that the child's eyes had always turned in. There was no history of birth injury.

On examination, both eyes turned toward the nose 40 to 45 degrees with little or no rotation externally. The child turned her head to see at the extreme right or left. When looking to one side, there was increased effort to converge with one eye but no noticeable external rotation of the opposite eye. The pupils reacted to light, and the discs appeared normal. No visual findings could be obtained. Attempted refraction under atropine cycloplegia gave: R.E., with a +2.50 D. sph. \ominus + 1.25D. cyl. ax. 15°. No figures were obtainable for the left eye because of poor fixation.

At the most recent examination, there was definite fixation with the right eye but no external rotation beyond the midline. The left eye still did not rotate externally, and the child cannot fix with this eye. In other words, there has been some improvement in external rotation of the right eye during the year that she has been under observation.

According to Whitnall, congenital factors are largely due to errors in development by cleavage from the common pre-muscular mesoblastic mass. Harold Gifford reported a series of cases in 1926, including unilateral and bilateral paralysis of external recti. He stated that the defect seemed to be due to hypoplasia or simple lack of development of the nucleus as opposed to the theory of intra-uterine disease. Some of his cases were associated

with other congenital defects, such as reduced adduction, paralysis of the facial nerve or tongue, or defects of the hands. However, no other congenital defects were observed in this case. The closeness of the 6th and 7th nuclei rather speaks for a central lesion. Birth injury is undoubtedly responsible for many supposed congenital ocular-muscle paralyses. The greater frequency of paresis of the left external rectus would lead to the belief that even moderate pressure in the birth canal will explain many cases.

HEREDO-FAMILIAL MACULAR DEGENERATION

DR. MARTHA RUBIN FOLK presented four cases.

Case 1. T. R., a white man, aged 25 years, complained of failing vision which began at the age of 18. Two sisters suffer from the same condition; the vision of the parents is apparently normal.

External examination of the eyes was negative. Vision was: R.E., 0.2; L.E., 0.2. The pupils reacted to light and accommodation. Examination of the fundi showed, in the macular region, a triangular area about one-third disc diameter, with some pigmentary disturbance as a pepper and salt macula. In the center of the macula, a darker pigmented patch was seen. The central fields showed a central scotoma, and the peripheral fields showed a 30-degree contraction for red. Treatment included lextron ferrous capsules and vitamin B₁.

Case 2. B. G., a white woman, aged 42 years, was first seen in September, 1945, with a complaint of gradual loss of vision which began at the age of 14 and was progressively getting worse. She married at the age of 21 and had three children, one of whom had trouble with her eyes. There were mild pigmentary changes in the macula with no loss of vision. The pa-

tient has one brother and one sister with similar eye conditions.

On examination, the eyes were negative externally. Vision was: R.E., 16/200; L.E., 0.4. Ocular movements were normal; irides were blue; pupils reacted to light and accommodation.

In the right macula, an atropic lesion with sharp margins was seen. This lesion, about two disc diameters in size, was sprinkled with pigment and gave a salt and pepper appearance. The left macula had a similiar lesion. The red fields were contracted to 30 degrees and also showed a central scotoma. Physical and laboratory examinations were negative. Treatment included vitamin B₁ (5 mgm.).

Case 3. S. K., a white woman, aged 34 years, gave a history of difficulty in reading as far back as she could remember. One sister and one brother had similar eye conditions. The mother and father were unaffected.

Vision was R.E., 0.1; L.E., 0.1. Ocular movements were normal. Pupils were 4 mm. in diameter and reacted to light and accommodation. In the macula was seen an apple-shaped atrophic area with sharply demarcated edges, and with a blood vessel running through the central portion of the lesion giving a salt and pepper appearance. A black-pigmented patch on a yellow base was seen in the center of the lesion. There was slight pallor of the disc. A similar lesion was seen in the left eye. Fields were normal. Physical examination and Wassermann test were negative. Red blood count was 3,500,000. Treatment included lextron ferrous capsules and vitamin B₁.

Case 4. This 26-year-old Negress was first seen on November 9, 1945, complaining of cloudy vision and pain in both eyes of two-weeks' duration. The first symptoms appeared when she was 17, at which time she was unable to see the blackboard

in school. At the age of 21, she was fitted with contact lenses.

There was a slight narrowing of the right palpebral fissure and mixed injection of the right bulbar conjunctiva. Both corneas were conical. An ectactic-leukomatous opacity about 4 mm. in size covered the papillary area, becoming more nebulous as it reached the limbus. Fine macular opacities were present, centrally and laterally, in the left cornea. The left fundus was seen merely as a red reflex. The right cornea stained with fluorescein; the left corneal epithelium was intact. The right anterior chamber was deep and, due to opacities, the fundus could not be made out. Refraction revealed a compound myopic astigmatism. Vision was: R.E. with a $-4.00D.$ sph $\ominus -3.00D.$ cyl. ax. 165° = ability to see fingers; L.E. with a $-3.50D.$ sph. $\ominus -3.25D.$ cyl. ax. = 0.1.

Diagnosis was: (1) bilateral conical cornea; (2) ectasia of the right cornea; (3) acute keratitis. Treatment consisted of pilocarpine solution, bichloride Hg ointment, and a tight bandage. This caused a recession of the cone to about 3 mm.; the mixed injection subsided; and the cornea improved.

In spite of the fact that the patient had worn contact glasses continuously eight hours a day for two years, the ectactic condition of the cornea was not alleviated and the degenerative processes continued.

RETINITIS PIGMENTOSA

DR. HAROLD D. BOCKOVEN presented two patients from Dr. Apple's service.

Case 1. A white man, aged 32 years, was first seen in August, 1945, complaining of marked loss of vision beginning at the age of 10. After examination at that time, he entered a school for the blind. Vision decreased progressively and, at the age of 21, he could no longer read. He has al-

ways been able to go about alone, having used a white cane for 10 years.

Family history showed that his father and mother were cousins. There were five children. An older brother was in a mental institution at the age of 13; the patient believed his brother's eyes were normal. Another older brother developed poor vision at the age of 10 and was totally blind at about 28 years of age. A younger brother had weak eyes and could no longer read at the age of 21. The sister's eyes were normal.

On examination, visual acuity, bilaterally, was light perception. Retinoscopy revealed refraction corrected by a $+3.00D.$ sph. $\ominus +1.00D.$ cyl. ax. 90° , bilaterally. There were moderate vertical nystagmoid movements, more marked at the extremes of rotation. Pupils were 5 mm. in diameter and reacted poorly to light. There were discrete, sharply outlined, minute opacities situated in the anterior third of each lens, more marked on the left. These opacities were bluish when observed with the slitlamp.

The discs were pale and waxy in appearance, with indistinct edges. Both arteries and veins were moderately constricted. The fundi were tessellated, and there was a moderate amount of pigment of the bone-corpusele type situated equatorially, frequently in close proximity to the retinal vessels. There was marked pigmentary disturbance at the left macula; both maculas appeared moth-eaten. Minute aneurysmal dilatations were present along the left superior temporal artery.

Case 2. A 50-year-old white man who was first seen October 17, 1945, complained of progressive loss of vision for five years, particularly in dim light. There was no history of past inflammation.

The patient had four brothers, two of whom had eye trouble; three sisters were normal. One brother, aged 46 years, had

had defective vision for 12 years, characterized early by night blindness, and was now practically blind. A second brother had a marked visual handicap, the nature of which is not known. There was no other significant family history, such as intermarriage.

Visual acuity equaled 0.1, bilaterally, and could not be corrected. Externally, a bilateral, diffuse, conjunctival injection and arcus senilis were noted. The pupils reacted to light and accommodation. The crystalline lenses were hazy bilaterally, posterior polar opacities being present. On fundus examination, the discs were pale and appeared waxy. The retinal vessels, particularly the arteries, were greatly attenuated. Both fundi were tessellated. Pigmentary deposits of a cobweb appearance were present equatorially. Bone-corporuscle type pigmentary deposits were present in both fundi, above and nasally. Some of these covered the blood vessels. Several large accumulations of pigment were situated peripherally. Bilaterally there was a peripheral form field, limited to from the 8- to the 10-o'clock positions, and a red field of 5 degrees.

PERSISTENT TUNICA VASCULOSA LENTIS WITH FIBROUS HYPERPLASIA

DR. E. M. GREEN presented three cases from Dr. Apple's service.

Case 1. D. G., aged 29 months, was first seen at the age of five months and was one of twins born eight weeks prematurely. His weight at birth was 3 lbs., 12 oz. Two preceding pregnancies resulted in normal, full-term deliveries. The three siblings, including the twin, had had no ocular complaints and follow-up revealed no pathologic condition in the twin. There was no history of acute illness in the puerperium or in the patient postnatally.

Physical examination revealed no gross pathologic condition, excepting the ocular defects. Bilateral microphthalmos and a

searching horizontal nystagmus were noted. Photophobia to strong light was present. An apparent dense, white corneal opacity occluded the iris on the right, temporally. The anterior chambers were shallow and the irides were light blue, with indistinct markings. With mydriatics, the right pupil dilated from 2 to 3 mm., irregularly and the left to 7 mm., evenly. On the Purkinje test, the light reflex from the posterior capsule of the lens was absent and, behind both lenses, was seen an opaque, white membrane on which blood-vessel remnants could be identified. A faint-red reflex was obtained from the nasal half of the left pupil. Tactile tension was normal.

The patient has been seen at regular intervals, and there has been no definite change in the eye findings.

Case 2. A. B., aged 11 months, was first seen at the age of five months with a history of increasing prominence of the right eye for the preceding two months. The patient was born 10 weeks prematurely and weighed 2 lbs. 13 oz. at birth. Otherwise, the history was of no significance.

Physical examination was negative except for the eyes. The left eye was microphthalmic. The right eye was enlarged, measuring 14 mm. in diameter. The left eye measured 10 mm. in diameter. The irides were light blue with indistinct markings, and the anterior chamber was absent or negligible, on the right, and shallow, on the left. The right eye was very firm on tactile tension, considerably more so than the left. Variable tonometric readings confirmed the tactile impression. An opaque, white membrane was noted behind the temporal portion of the right lens but, through the nasal portion, a clear view of a normal fundus and non-cupped disc was obtained. In the left eye, the membrane was more extensive, and only a faint-red reflex was obtained through the nasal half. Ciliary processes

extending in the left pupil were seen.

After a trephine of the right eye was performed on June 14, 1945, no further enlargement occurred. Normal ocular tension was obtained.

Case 3. P. P., aged two years, was first seen in October, 1945. She was born 10 weeks prematurely and weighed 1 lb. 13 oz. There was no history of acute illness during the puerperium or in the patient postnatally.

Physical examination was negative except for the eye findings and prominent frontal bosses. Photophobia to strong light was present. Both eyes were small and deep set, and a searching horizontal nystagmus was present. An apparent, whitish corneal opacity obscured the superior portion of the irides, bilaterally. The anterior chambers were extremely shallow or absent. The irides were light blue, the markings indistinct, and they had a fetal appearance. The pupils dilated irregularly, the right from 3 to 4 mm. and the left from 2 to 3 mm. with homatropine. The lens substance was clear, but the light reflex from the posterior lens

capsule was absent. Behind both lenses was seen a thick, white, opaque membrane. There was no red reflex on either side. Laboratory and x-ray studies were not significant.

On October 10, 1945, a combined linear extraction of the right lens was performed, and an attempt was made to push the membrane to one side. Postoperatively, no iris coloboma was noted, and the small pupil present was occluded by fibrous adhesions. A wide complete iridectomy was performed on November 10, 1945. Nine days later, the findings showed the white membrane presenting anteriorly through a large pupillary opening.

SCIENTIFIC PROGRAM

LEGAL OPHTHALMOLOGY

Mr. Joseph Hinshaw read a paper on this subject which has been published in this Journal (September, 1946). Discussion was by Drs. Guibor, Soper, Hoffman, Mundt and Zeiss, and in closing by Mr. Hinshaw.

Robert Von der Heydt.

AMERICAN JOURNAL OF OPHTHALMOLOGY

Published Monthly by the Ophthalmic Publishing Company

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THE 1946 ACADEMY MEETING

The week of October 13th to 18th, the Palmer House in Chicago unveiled one of the biggest and best conventions of the American Academy of Ophthalmology and Otolaryngology in its 51 years of existence. More than 3,000 members and guests registered, and every facility was bursting with more or less happy doctors in search of knowledge. The Academy meeting has often been likened to a three-

ring circus, and the similarity continued in force this year, perhaps with a few more rings added.

The presence of many ex-medical officer members, old and new, resulted in impromptu reunions of veterans from the various theaters of operations, and many a hospital campaign was refought and experiences reviewed.

There were several innovations arranged for by the officers after much

thought and hard work. On the whole, these innovations were happy ones. The alternation of the Eye and Ear, Nose and Throat divisions in scientific assembly and instruction hours resulted in less crowding and more efficient handling, especially in the courses. The scientific programs were better than usual. The interspersing of motion pictures between scientific papers was an interesting experiment, meeting with favor by some and disfavor by others. In spite of some criticisms heard here and there, it would seem that most of the members enjoyed the new arrangement. The hall was crowded even through the last session.

The instruction courses were packed, and most of them were completely sold out. After the drought of the war years, everyone seemed thirsty for information and eagerly drank at the springs of knowledge set up in prosaic hotel rooms by the efficient secretaries.

The Jackson Memorial Lecture was given on the evening of October 16th by Dr. Alan C. Woods, the president-elect. The title of his comprehensive and stimulating address was "The influence of hypersensitivity on endogenous uveal disease." It is a valuable contribution to ophthalmology, summarizing what has been the author's life work of deep thought, study, and experimental research.

The Ear, Nose, and Throat members enjoyed an extra fillip in acting as hosts to the Pan-American Congress of Otorhino-laryngology and Broncho-esophagology which immediately followed the convention. The presence of outstanding South American scientists and particularly their vivacious and charming wives made the meeting a colorful one and added much to the gaiety of the gathering.

The scientific exhibits were well-chosen and displayed. This important feature of the Academy was always filled with members seeking what was new, and none left

without adding something of great value to himself and to his patients. Ten of the 24 displays were from the ophthalmic division. Awards were given to Dr. Donald J. Lyle of Cincinnati, Ohio, for the teaching value of his extensive exhibit on "Neuro-ophthalmology;" to Dr. Walter H. Fink of Minneapolis, Minnesota, for the originality of his exhibit on "An anatomical study of the oblique muscles of the eye;" and to Dr. A. D. Ruedemann of Cleveland, Ohio, for the excellence of presentation of his exhibit on "Plastic eye implant." This last won the gold medal at the A.M.A. convention in San Francisco in June.

It was good to see so many familiar and friendly exhibitors displaying their goods and receiving orders in the Technical Exhibit Hall. Many of the orders will take a long time to be filled in these days of reconversion shortages, of course. But the display was there, with great promise of good things to come, and it was like old times. The war years had receded, and one was back again, seeing, handling, comparing, and discussing the tools of his trade with his colleague and exhibitor just as if a cataclysm had not occurred.

At the luncheon given to the faculty by the president, Gordon B. New, the Leslie Dana Medal of the National Society for the Prevention of Blindness, the St. Louis Society for the Prevention of Blindness, and the Association for Research in Ophthalmology was presented to Harry S. Gradle for his outstanding contributions to the prevention of blindness, to ophthalmology, and to the teaching of ophthalmology. Conrad Berens gave the presentation citation which will be printed in the Journal in a subsequent issue, and the medal to Mrs. Gradle representing her husband who was prevented by illness from being present, much to our regret and sorrow, for Harry Gradle is one of our best loved members.

In spite of its size, which is increasing yearly, the Academy functions on well-oiled and well-guided ball bearings. One need have no misgivings as to its future, for it is here to stay in very much its present form for many years to come, because it gives utmost service to each of its eager and loyal members.

Derrick Vail.

TRAINING NONMEDICAL HELPERS IN OPHTHALMOLOGY

As to possibilities of development for the good of ophthalmology, and therefore of the general public, perhaps the most important paper presented to the recent San Francisco meeting of the American Ophthalmological Society was that read by Parker Heath on "Medical Assistance at Professional Level."

Heath recognizes a serious shortage of physicians, not only as existing at the present time, but as likely to continue for some years to come. The war has had much to do with causing this shortage which is especially serious in the field of ophthalmology; but some of us may be disposed to question whether the shortage is more particularly one of personnel or rather of effective training of that personnel.

The remedies so far proposed include "larger classes at undergraduate level, increasing the number of residents and internes, provision for more fellowships, refresher courses, and basic training programs in the specialties."

The medical profession, we are reminded, has trained special groups of lay persons to aid in caring for the sick. These groups include nurses, laboratory helpers, X-ray technicians, office employees, and special workers in research. The only department in which ophthalmology has made a serious attempt to cope with the problem of training expert assistants is that of orthoptics.

Heath suggests that ophthalmology is probably more adaptable to professional assistance than any other specialty. Aspects of ophthalmology suggested as lending themselves to special training and utilization of lay assistants include refraction, muscle balance, tonometry, external and ophthalmoscopic examination, photography, some forms of therapy, perimetry, screening tests in schools and industry, the care and preparation of instruments, assistance during operations, laboratory procedures, the fitting of contact glasses, and the assembling of material for scientific essays.

It is apparently contemplated that non-medical persons, expertly trained for these multifarious activities, shall assume much of the work at present undertaken by medical graduates who either have received a more or less complete training in ophthalmology or are seeking such training under the preceptorship of the medical chief with whom they are associated.

It is pointed out that at the present time many of us delegate parts of our examination of patients to personnel trained by the preceptor method, "a method which requires many years and does not turn out enough well-rounded trained people to meet the demands or the possibilities." To increase the numbers of such persons, and to insure their proper training, Heath would establish a special college curriculum of four years and leading to a bachelor's degree. The first two years of such a course would be taught by the usual literary and scientific faculties, while the last two years would be devoted to the medical field, and responsibility for them would devolve upon medical teachers. The author's outline of a curriculum for these last two years includes most of the subjects ordinarily taught to graduate students in ophthalmology. For example, it is proposed to devote 240 hours to anatomy including

dissection, 576 hours to refraction, 216 hours to physiologic chemistry, 144 hours to histology of the eye, 216 hours to pathology, 144 hours to clinical and laboratory technique, 72 hours to ocular muscles, 280 hours to orthoptics, and 200 hours to perimetry.

It may be assumed that this proposal to create an important new professional group has grown out of the urgent need of those who are carrying on large ophthalmic practices, as well as in many instances administering important public clinics. Such leaders in ophthalmology have no doubt tried and found wanting the usual employment of medical assistants or associates, as well as the rather slow and laborious process of preceptorship as applied to a well-educated secretary or nurse. Many medical assistants and associates have been grievously missed during the war period. Some of them have returned from war service anxious to carve independent careers.

To many of us, sympathetic consideration of the present proposal may suggest questions as to its effect in the first place upon the individual ophthalmologist who might employ the new type of graduate, and in the second place upon the practice of ophthalmology as a whole.

How long, we may inquire, would it take not merely to induce a number of important colleges to create such a course leading to a degree, but also to interest a large body of students in such a course? At first the applicants are likely to be drawn from the ranks of those high school students or graduates who have already felt themselves impelled toward the regular nurse's training. Further, how long would it take to induce a large number of ophthalmologists to replace their present helpers by such new graduates?

Allowing for the time necessary to attract a body of students, for the length of time to be occupied by the course itself,

and for the education of the profession of ophthalmology in the utilization of such graduates, it seems not unlikely that ten or twelve years would be a moderate estimate of the period within which we could expect a large number of such non-medical graduates to have been launched upon their new career.

To what extent would the provision of such highly trained nonmedical office assistants tend to reduce the opportunities for development of young ophthalmologists who might expect to start their careers as assistants to established practitioners of the specialty? Is the desire to establish such a nonmedical graduate group partly based upon the fact that medically qualified assistants have ambition beyond that which may be expected of a lay assistant, and are apt sooner or later to undertake their own competitive practice of ophthalmology?

Is it to the advantage of the general public that much of the practice of ophthalmology shall be concentrated in the hands of a few leaders who make use of lay assistants, or will such public advantage be best served by the training of as many medical ophthalmologists as the market can support?

Is there not much to be said in favor of the individual and direct personal relation between ophthalmologist and patient rather than the delegation of professional tasks to a lay assistant who reports back to the ophthalmologist?

Would not the length of time necessary to produce substantially useful results from the new proposal be better utilized in working toward the creation of improved facilities for the post-graduate training of medical men in ophthalmology?

Many leading ophthalmologists are at present excessively overburdened with the teaching of undergraduate and postgraduate medical students. Really intensive

training of those preparing for expert assistantship to ophthalmologists might be expected to add materially to the educational labors of those called upon to establish such facilities. If the training bestowed upon this new group of students is not of the highest possible quality, it is not worth giving at all.

Too many physicians practicing eye, ear, nose, and throat in the larger country towns are appreciably better trained in otolaryngology than in ophthalmology. Such men might easily delegate a large part of their work in ophthalmology, and especially in refraction, to a graduate lay assistant, who then might easily prove to be the rather effective competitor of an independent ophthalmologist in the same town. Such a contingency could hardly be regarded as generally advantageous to ophthalmology as a whole.

Is there any possibility that a considerable number of these specially trained lay assistants would be enticed into selling their services to osteopaths or chiropractors, or even to optical concerns which advertise expert examination in refraction?

Have not the older ophthalmologists, firmly established in their specialty, a moral duty to assist in the development of a younger generation of medical ophthalmologists rather than in the creation of a new nonmedical group of workers in the specialty and particularly in the practice of refraction?

In its ultimate elaboration, the proposed scheme for training of expert office assistants below the graduate medical level might prove of great public benefit, especially in the event of development of a large measure of socialization of medicine. Whether it would be of general advantage to the profession of ophthalmology, as at present constituted, is a question to which we may properly devote serious and deliberate consideration, bear-

ing in mind every conceivable aspect of the subject.

W. H. Crisp.

DI-ISOPROPYL FLUOROPHOSPHATE IN GLAUCOMA

During the past few years several new drugs have been introduced for the treatment of glaucoma. The most recent of these is Di-isopropyl Fluorophosphate (D.F.P.). The fluorophosphates have been shown to be powerful parasympathamimetic drugs due to their ability to destroy cholinesterase. They are quite toxic and during the recent war were considered as potential chemical warfare agents by both the enemy and ourselves. In the course of chemical warfare experiments, the marked miotic effect of D.F.P. on the pupil suggested its possible use in the treatment of glaucoma.

D.F.P. $[(C_3H_7O_2)_2 P O F]$ is a rather unstable compound with a faint fruity odor. Its freezing point is $-50^\circ C.$, and its boiling point is $183^\circ C.$ Its stability is greatly enhanced in solutions of peanut oil.

The recently published clinical investigations of McDonald and of Leopold and Comroe indicate that we have in D.F.P. a valuable addition to the arsenal of anti-glaucomatous agents. In many cases, it will control the intraocular pressure when the more conventional treatment with eserine and pilocarpine has failed. In others, it will be no more effective than these standard drugs have been. Its chief advantage seems to be in its prolonged action, and the lack of necessity for frequent instillations. Another valuable asset is its ability to overcome the mydriatic and cycloplegic effect of atropine. This will be welcome news to those ophthalmologists who have had the misfortune to deal with a case of glaucoma precipitated by cycloplegic examination, or by

the mistaken use of atropine for a miotic.

Like any other miotic D.F.P. may produce certain untoward affects. It can cause ocular and brow pain due to powerful ciliary spasm. Headache and photophobia have been complained of following its use. Systemic affects from absorption from the conjunctival sac have occurred in experimental animals; one drop of the full-strength solution in the eye of a rabbit has caused death within two to three minutes. Therefore, it is a drug to be treated with respect and not used indiscriminately. However, Leopold and Comroe have not found any systemic affects in man when employing it in 0.2-percent solution, an observation which agrees with this writer's experience.

Other series of cases must be studied before D.F.P. becomes available for general use. Time will tell whether or not it will prove as effective as preliminary reports make it appear to be.

Edwin B. Dunphy.

BOOK REVIEWS

OPHTHALMOLOGY IN THE WAR YEARS. Vol. 1 (1940-1943). Edited by Meyer Wiener, M.D. Clothbound, 1,166 pages, references, subject index, and author's index. Chicago, 304 South Dearborn Street, Year Book Publishers, Inc., 1946. Price, \$13.50 postpaid.

Thirty-six contributors, most of whom are widely known and all of whom are experts, combined under the able editorship of Dr. Wiener to produce a volume of great practical use and value to all English-reading ophthalmologists. The cruel war years, among other and less serious things, forced many ophthalmologists either through isolation in military service or through the overburden of

routine office work, to give up the reading of current ophthalmic literature, which is the life blood of progress in our great specialty. To fill in this gap in our knowledge, the present volume and its subsequent fellow were conceived.

The editor says in his preface that "it has been the purpose of the editorial staff to supply as complete a bibliography as possible and to give not merely an abstract but a running comment on articles which, in each editor's estimation, merited a review." These purposes have been amply fulfilled, to the great credit of the contributors and the staff. When one considers how busy these men and women were and are, what difficulties were encountered in obtaining the articles, the restricted lists of foreign journals and ophthalmic literature in general, and other hardships in war-time, one can but marvel that such a splendid and complete piece of work could result.

Each contributor read, digested, reviewed, and commented on anywhere from 50 to 800 published articles in his particular field. The expert judgment shown in discrimination makes each chapter an authority of the subject under discussion, and emphasizes the peaks of progress in our specialty in the years January, 1940, through December, 1943.

All parts of ophthalmology are covered, including, as well, comparative ophthalmology, hygiene, sociology, education and history, methods of examination, and industrial ophthalmology.

One is indeed proud of this achievement in American ophthalmology, and grateful for the wealth of ophthalmic literature, collected under such trying conditions, that is made available in one volume to all of us. That it will be fruitful and productive of ideas, useful in the solution of one's daily problems, and a ready source of reference and stimulation needs no comment. The editor, the contributors,

and the publishers are to be congratulated, commended, and thanked by ophthalmologists everywhere.

Derrick Vail.

DISEASES OF THE EYE. (Revised edition.) By Konstantin Pascheff. 495 pages, 288 illustrations, 12 plates. Sofia, University Publication, 1946.

This is the second edition of the first textbook on ophthalmology in the Bulgarian language, and it is supplemented by the ophthalmic advances made from 1929 to 1946. The author is a prolific contributor to ophthalmic literature, and he uses much of his published material in this book. The book is divided into 12 chapters, dealing with diseases of the orbit, lids, lacrimal apparatus, motor system, sensory and sympathetic systems, conjunctiva, cornea-sclera, uvea, visual apparatus, the lens and vitreous, and the

globe including glaucoma and anomalies of refraction. The last chapter deals with surgery as it is being performed in the author's clinic at the University of Sofia. Each chapter covers briefly methods of examination, congenital anomalies, circulatory disturbances, inflammation, degeneration, injury, tumor, prophylaxis, and therapy. The profuse illustrations with drawings, photographs, and microphotographs, and the condensed, although precise and clear, descriptive material will widen the ophthalmic horizon of the medical student without burdening him with much reading. The textbook is, nevertheless, sufficiently complete to be of value to the general practitioner and to serve as an excellent guide to the student of ophthalmology. Worthy of note are the plates of illustrations on trachoma and congenital ectopia of the lens.

Ray K. Daily.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

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| 1. General methods of diagnosis | 10. Retina and vitreous |
| 2. Therapeutics and operations | 11. Optic nerve and toxic amblyopias |
| 3. Physiologic optics, refraction, and color vision | 12. Visual tracts and centers |
| 4. Ocular movements | 13. Eyeball and orbit |
| 5. Conjunctiva | 14. Eyelids and lacrimal apparatus |
| 6. Cornea and sclera | 15. Tumors |
| 7. Uveal tract, sympathetic disease, and aqueous humor | 16. Injuries |
| 8. Glaucoma and ocular tension | 17. Systemic diseases and parasites |
| 9. Crystalline lens | 18. Hygiene, sociology, education, and history |
| | 19. Anatomy, embryology, and comparative ophthalmology |

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VISUAL TRACTS AND CENTERS

Damel, C. S., Dickmann, H. G., and Just Tiscornia, B. **Considerations on five cases of optochiasmic leptomeningitis.** *Arch. de Oft. de Buenos Aires*, 1943, v. 18, Oct., p. 481.

The authors, who prefer the term optochiasmic leptomeningitis to the more common one of optochiasmic arachnoiditis, report their findings in five cases of this disease, in all of which the clinical diagnosis was verified at operation. The greater incidence of the condition in men in the second and third decades of life is stressed. The disease may be primary and the chiasm involved alone, or it may be secondary to other diseases affecting the central nervous system, such as encephalitis, tabes, and multiple sclerosis. The etiology is quite varied; trauma, focal infection, tuberculosis, and syphilis are the most common causes. While polymorphism of the visual fields is characteristic of the disease, concentric and irregular contraction is the most fre-

quent perimetric occurrence. The fundus generally shows optic atrophy, although this may exceptionally be accompanied by edema. The authors favor early surgical intervention, not only in cases of known etiology, in which the medical treatment fails to arrest the progress of the disease, but also in those cases in which the etiology is unknown. They believe that a judicious combination of medical and surgical treatment will improve the percentage of favorable results. (Visual fields, tables, and bibliography.)

Plinio Montalván.

Godtfredsen, Erik. **Ophthalmologic and neurologic symptoms of malignant nasopharyngeal tumors.** *Acta Ophth.*, 1944, Supplement 22, pp. 273. (See Section 15, Tumors.)

Hughes, E. B. C. **Some observations on the visual fields in hydrocephalus.** *J. Neurol. Neurosurg., and Psychiat.*, 1946, v. 9, Jan., pp. 30-39.

Little attention has been paid to chiasmal changes produced by a dis-

tended third ventricle in obstructive hydrocephalus. There has been some confusion because of papilledema and secondary optic atrophy. The patients studied in this series are without evidence of optic atrophy. The earliest change is very small paracentral scotomas in the apex of the lower temporal quadrant which is usually bilateral. The scotomas are thin, have small visual angles, and are usually centrocaecal. As the scotoma gradually enlarges the adjacent isopters become involved locally. The next change is a depression of visual acuity in the affected quadrant and is characterized by a recession of the central isopters and graying of the affected fields (white objects appear hazy, dirty, gray, pale green). Graying is seen more commonly in chiasmatal lesions, and stops at the midline inasmuch as crossed fibers are involved. With further progress the depression type of field comes into play and a gradual loss of central isopters ensues until most of the lower temporal quadrant is lost. Later some graying occurs in the nasal field. Small scotomas may also appear in the upper temporal quadrant.

I. E. Gaynon.

Porsaa, Kaj. The central visual field after occipital lobectomy. *Acta Ophth.*, 1944, v. 22, pt. 2, pp. 243-260.

Porsaa reviews the literature on bilateral representation of the macula, and reports five cases of hemianopsia without sparing of macular vision after occipital lobectomy for neoplasm. In one case, there was macular sparing preoperatively, but it was lost after the operation. Porsaa believes that these observations conclusively prove the absence of bilateral cortical macular representation. The sparing of the macula, when it is found, is to be attributed to an extensive macular repre-

sentation in the calcarine area, part of which is left intact. Ray K. Daily.

Traquair, H. M. The nerve fibre bundle defect. *Trans. Ophth. Soc. United Kingdom*, 1944, v. 64, p. 3. (See Section 10, retina and vitreous.)

Zeligs, M. A. and Joseph, G. F. Unilateral internal ophthalmoplegia. *Arch. Neurol. and Psychiat.*, 1945, v. 54, Nov.-Dec., p. 389.

Isolated unilateral ophthalmoplegia may be the only clinical sign in a patient with syphilitic meningitis. A case history illustrating such an occurrence is presented. The diagnostic importance of serologic study in cases of unexplained pupillary paralysis is emphasized. The rapid therapeutic response to penicillin therapy is mentioned. The probable anatomic site of such a lesion is postulated. Theodore M. Shapira

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EYEBALL AND ORBIT

Bardram, M. T. Progressive exophthalmos (so called malignant exophthalmos). *Acta Ophth.*, 1944, v. 22, pt. 1, pp. 1-26.

The literature of exophthalmic ophthalmoplegia is reviewed, and three cases following thyroidectomy are reported. All three cases had an increased output of gonadotropic hormone, and one had an increased metabolic rate with other symptoms of thyrotoxicosis. In one patient the exophthalmos abated after a Naffziger decompression; in the other two it was controlled by conservative treatment. (3 illustrations.)

Ray K. Daily.

Bengisu, N. A crouzon type of craniofacial dystosis in a father and daughter. *Oto-Nöro-Oft.*, 1946, v. 1, pp. 1-5.

The author reports two cases of cranio-facial dystosis characterized by the triad of exophthalmus, and deformity of the cranio-facial and maxillary bones. The anterior segment of the father's eyeball had been amputated because of lagophthalmic keratitis. The daughter had an early postedematous optic atrophy. I. E. Gaynon.

Bertotto, E. V. **Congenital paralysis of the lateral rectus and melanosis bulbi.** *Anales Argentinos de Oft.*, 1945, v. 6, Apr.-May-June, pp. 60-62. (See section 4, Cornea and Sclera.)

Blegvad, Olaf. **Myxoma of the orbit.** *Acta Ophth.*, 1944, v. 22, pt. 2, pp. 131-140.

The five cases reported in the literature are briefly reviewed and an additional one is described clinically and histologically. In the course of six years a woman, 29 years of age, developed a hyperopia of eight diopters in the left eye and a tumor the size of a walnut in the temporal side of the left orbit. The symptoms, in addition to the refractive changes were exophthalmos, impaired ocular motility, loss of vision, pain in the eye, and a stellate folding of the retina, with the macula as a center. The retina in this area was edematous, and the author attributes the folding to pressure by the tumor. Five months after the surgical removal of the neoplasm the exophthalmos subsided, the ocular motility was restored, but the retinal folding, impaired visual acuity, and hypermetropia were still present. (4 illustrations.)

Ray K. Daily.

Erpf, S. F. Wirtz, M. S. and Dietz, V. H. **Plastic artificial eye program.** *U.S. Army. Amer. Jour. Ophth.*, 1946, v. 29, August, pp. 984-992. (8 figures, references.)

✓Cutler, N. L. **A basket type implant for use after enucleation.** *Arch. of Ophth.*, 1946, v. 35, Feb., pp. 71-83.

The author describes a new type of orbital implant which has been used 50 times in an Army general hospital. Following enucleation, a specially constructed basket-like implant is secured in Tenon's capsule by three sutures. The sutures are tied over a button which is forced down into the implant in such a way as to produce a depression in the socket. Both implant and button are made of Lucite (methyl methacrylate). A plastic retainer is then placed behind the lids and a moderate pressure bandage is applied. Within three weeks a special plastic artificial eye may be worn.

Actual measurements of motion were made on 20 patients in which there had been no implant, 20 with a ball implant, and 20 with the new basket implant. The average range of motion expressed in degrees for no implant was 69, for the ball implant 74, and for the basket implant 109. It was found that with the basket implant and a new type of prothesis there was more instantaneous movement and a wider range of action. Thirteen illustrations depict the operative technique. John C. Long.

✓García Nocito, P. F., and Zubillaga, J. B. **Frost-Lang operation.** *Arch. de Oft. de Buenos Aires*, 1943, v. 18, Oct., p. 513.

After discussing the different techniques for enucleation with implant, the authors express their preference for the Frost-Lang operation. They used vitallium and lucite implants with very good results. The article is illustrated. Plinio Montalván.

Givner, Isadore. **Reconstruction of the floor of the orbit.** *Amer. Jour.*

Ophth., 1946, v. 29, August, pp. 1010-1012. (3 figures, references.)

Godtfredsen, Erik. **Orbital complications following operations on the paranasal sinuses.** *Acta Ophth.*, 1944, v. 22, pt. 4, pp. 401-418.

The conclusions are reached from a study of 42 cases gathered from the literature and eight cases in the author's personal experience. The tabulated data show that in surgery of the frontal and maxillary sinuses orbital complications are rare and insignificant. They are more frequent and severe after surgery of the ethmoid labyrinth, usually in the form of orbital hematoma or optic nerve lesions. At the onset of orbital complications the eyegrounds should be examined; the appearance of orbital stasis is an indication for orbitotomy and orbital drainage, which if performed promptly will restore vision. Unless this is done within 24 hours of the onset of an optic nerve lesion the prognosis is poor. (4 illustrations.) Ray K. Daily.

Ingalls, R. G. **Penetrating wounds of the cornea with hypopyon treated with penicillin.** *Amer. Jour. Ophth.*, 1946, v. 29, Sept., pp. 1152-1154. (2 figures.)

Jaquelin, A., Turiaf, J. D. **Atypical ocular tuberculosis; tuberculin tests; and tuberculin therapy.** *Ann. d'Ocul.*, 1945, v. 178, Nov., pp. 514-527.

Atypical tuberculous lesions are relatively frequent not only in the eye but also in the joints, skin, bronchi, and nervous system. The injection of tuberculin in sufficient amount will produce aggravation of usually mild chronic lesions in these parts if they are tuberculotoxic in origin. Their frequent association leads the authors to consider them as a syndrome, char-

acterized by pathologic lesions found in tuberculosis but without the presence of the specific organism. The subcutaneous injection of tuberculin is advised for diagnosis and treatment. For diagnostic purposes, 0.5 mg. is injected subcutaneously. If no reaction occurs in four days 1 mg. is given, and if necessary 5 mg. is injected four days later. In treatment with tuberculin one strives to avoid a general or local reaction. Of 48 patients, 26 were considered cured, that is the process was inactive for more than two years. There were 13 cases of iridocyclitis, 6 of iritis, 3 of sclerokeratitis, 2 of keratoconjunctivites, 1 of iridochoroiditis, 1 of uveitis. Among the complete failures were 3 cases of iridocyclitis, 2 of sclerokeratitis, 1 of iritis, 1 of iridochoroiditis, 1 of chorioretinitis, and 1 of choroiditis. In thousands of injections only two fatalities could possibly be attributed to tuberculin injections. In a man, 63 years of age, fatal meningitis occurred shortly after the injections were begun. In another patient, severe hemoptysis followed the injection of tuberculin.

Chas. A. Bahn.

Jensen, C. F. D. **Tantalum enucleation implant.** *Amer. Jour. Ophth.*, 1946, v. 29, Sept., pp. 1151-1152. (3 figures, references.)

King, E. F., and Samuel, E. **Fractures of the orbit.** *Trans. Ophth. Soc. U. Kingdom*, 1944, v. 64, pp. 134-154.

The authors present the classification of fractures of the face of McIndoe and describe several types of fractures of the nasomaxillary complex or central bony mass. In an upper fracture the line traverses the root of the nose and in the orbit divides the roof from the inner and outer walls. The facial bones are separated from the cranium and

severe intracranial hemorrhage ensues. In a middle fracture the line traverses the nasal bones, the inner wall and floor of orbit to the infraorbital foramen, and the anterior face of the maxilla to the pterygo-mandibular fossa. The detached bony mass tends to be displaced backwards and a flattened dishface results.

Another type of fracture which is not frequent is a downward displacement of part of the orbital floor, unassociated with any damage to the margin of the orbit or surrounding facial bones.

Damage to the eye must be given first place in diagnosis and treatment. Hemorrhage that appears in the lids some hours after an injury suggests an underlying fracture. Surgical emphysema indicates communication with the ethmoid cells or antrum. It increases on blowing the nose and usually subsides in a few hours. Loss of continuity of the orbital margin with local tenderness indicates an orbital fracture. Proptosis is due to displacement of the globe by bony fragments or hemorrhage within the cone of muscles. When it occurs some weeks or months later it indicates an arteriovenous aneurysm, usually of the cavernous sinus and occasionally of the orbital vessels. It is accompanied by a bruit, pulsation of the globe, and congestion of the veins of the lids and retina. Proptosis may lead to exposure keratitis. Endophthalmos and downward displacement of the globe can be due to depression of the orbital floor if there is an associated rupture of the suspensory ligament of Lockwood. An intractable sinus may result from a foreign body. Anesthesia in the areas of distribution of the infraorbital or other branches of the trigeminal nerve also suggests fracture. Traumatic stricture of the

nasolacrimal duct with secondary infection of the sac may occur in fractures of the nasomaxillary complex.

Pressure on the nerve in the optic canal, hemorrhages into the nerve sheath, traumatic arachnoiditis, and lesions of the vessels that supply the optic nerve result in reduction of vision. Diplopia is the most important ophthalmic sequel and is often the dominating permanent disability.

In the early stages treatment consists of reduction of the bony deformities. Later little more than cosmetic improvement by the insertion of subcutaneous bone-grafts is possible. The defective movement of the globe usually can be corrected surgically only if it is due to paralysis of individual muscles. (12 figures.)

Beulah Cushman.

Lech Junior. **Plastic operations on the orbital cavity.** Arquivos do Instituto Penido Burnier, 1945, v. 7, Dec., pp. 30-56.

The paper deals with correction of the orbital cavity for readaptation of prosthesis. The subject is covered under the headings of bloodless dilatation, topographic anomalies, absence of lower cul-de-sac, subtotal and total retractions of the cavity, and conclusion. The methods of a number of authors are described and illustrated. (23 illustrations, bibliography.)

W. H. Crisp.

Mata Lopez, Pedro. **Concerning a form of ocular sympathalgia.** Arch. de la Soc. Oft. Hisp.-Amer., 1945, v. 5, May, pp. 371-377.

There are certain patients who complain of dull pain about the orbits that is sometimes associated with close work but not dependent upon it, vaso-

motor disturbances of the anterior pole of the eye of the sympathetic type, slight photophobia, and at times slight rhinorrhea. The syndrome seems to have features in common with the syndrome of Sluder and possibly should be included with it. Phenolization of the sphenopalatine ganglion has been found to produce a rapid and lasting cure.

J. Wesley McKinley.

Moras, P. V., Deschamps, J. L., and Ardouin, M. Diagnostic remarks and therapeutics of ocular tuberculosis. *Ann. d'Ocul.*, 1945, v. 178, Nov., pp. 490-513.

In a detailed study of 30 patients, 10 were male, 20 female, and more than half under 25 years of age. In one half of the patients only one eye was affected. The following conditions other than simple phlyctenulosis, were observed: kerato-conjunctivitis, recurrent phlyctenular type, 2; interstitial keratitis, nodular type, 1; sclerokeratitis, 7; iritis and iridocyclitis (anterior uveitis) 10; hyalitis and diffuse choroiditis (posterior uveitis) 6; circumscribed choroiditis 2; tuberculous periphlebitis 1; recurrent hemorrhage 1. In several patients the following sequence was noted: phlyctenulosis, sclerokeratitis, iritis, anterior uveitis, and posterior uveitis. In the thirty patients studied not one case of classical ocular tuberculosis was observed. Twenty-five percent of the patients had tuberculous antecedents. A positive cutaneous tuberculin reaction was considered of value only in the very young. Radiologic examination of the thorax, done in every patient, frequently did not show active lesions concurrent with the ocular lesions, but did show scars and calcification. Among the clinical manifestations observed were recurrences

after fatigue and healing after rest and other hygienic measures. Scleral involvement in phlyctenular recurrences, slight corneal vascularization, a chalky appearance of the cornea, segmentary or annular corneal lesions were frequently observed. In iridocyclitis common manifestations were hemorrhage into the iris, large gray adherent fibrinous exudates, and early depigmentation of the iris. Secondary glaucoma occurred in three of ten eyes with uveitis. Tuberculous iridocyclitis may develop rapidly after a sudden onset and may improve after injections of mercury cyanide. In choroiditis changes of pigmentation are slight, delayed, and limited to the margins of the lesion. Of little value were the Verne resorcin reaction, globular sedimentation, and the Besredka complement reaction. The tuberculin test is considered final, quantitatively and qualitatively. One, two or three subcutaneous injections of tuberculin are used depending on the amount and character of the reaction. The first injection consists of 1 cc. of a solution containing 1 mg. of tuberculin. If negative, in three days a second injection of 3 mg. in similar dilution is administered and in five days 5 mg. is injected. The reactions may be local, general, or ocular. The last consists of increased sensitiveness, photophobia, slight diminution of vision, increased injection, increased hemorrhage, and hypertension. If intelligently used, permanent ill effects are rare. A positive reaction is definitely diagnostic of a tuberculous etiology and a negative reaction rules it out with equal certainty. The treatment advised is tuberculin in small but increasing doses with avoidance of a focal or general reaction. Six months may be required for appreciable im-

provement and twelve months for a cure. Tuberculin treatment is contraindicated in advanced or hemorrhagic pulmonary tuberculosis. Residence in altitudes more than 5000 feet above sea level is considered an important adjunct to other treatment. Among auxiliary treatments considered worthy of further study are local light therapy, auto-hemotherapy, and the prolonged injection of vitamin D and calcium. A detailed analysis of the progress and treatment of the 30 patients studied is reported.

Chas. A. Bahn.

Quintana, Juan. **Orbital mixoma.** Arch. de la Soc. Oft. Hisp.-Amer., 1945, v. 5, May, pp. 346-351.

A pure orbital mixoma is rare. Such a tumor was found in the anterior inferotemporal position of the orbit. It caused exophthalmos with displacement of the globe upward and inward. Extirpation was complete without recurrence in six months.

J. Wesley McKinley.

Rønne, Gerhard. **Local treatment of intrabulbar infections. The clinical and histological picture of staphylococcus infection.** Acta Ophth., 1944, v. 22, pt. 1, pp. 105-116.

A clinical and histological description of the course of experimental intrabulbar staphylococcus infection, into the anterior chamber, and into the vitreous is presented. Fifty bacteria of the strain used by the author injected into the vitreous were sufficient to produce perforation of the eyeball within four days. The symptoms, which appeared on the second day, were exophthalmos, corneal edema, and conjunctival injection and secretion. The histological picture is characterized by a primary reaction in the retina and

ciliary body; choroidal changes appear later, and the anterior ocular segment remains free of bacteria for a long time.

Ray K. Daily.

Rudemann, A. D. **Plastic eye implant.** Amer. Jour. Ophth., 1946, v. 29, August, pp. 947-952. (11 figures.)

Rundle, F. F. **Observations on a case of orbital varix.** Clinical Science, 1945, v. 5, Dec., pp. 139-144.

This condition produces a characteristic clinical syndrome including the dramatic phenomenon of transient severe proptosis. A man, 45 years of age, complained of a protrusion of his right eye on stooping. The position of the right eye in its orbit varied in the different positions of the body whereas the left eye remained in the same position at all times. The Hertel exophthalmometer was used for measurements. When the cervical veins were compressed by means of a pneumatic cuff placed around the neck, the exophthalmos reached a maximum of 18 mm. At this point the eyeball moved 2 mm. laterally but not upwards or downwards. Recession proceeded rapidly after release of the compression. The visual acuity and field, fundus, pupil, and pupillary reactions were normal. When maximal compression was maintained for five to eight seconds the eye became blind, but vision returned to normal ten seconds after compression was released. Distinct pulsation of the globe, synchronous with the carotid pulse, occurred when the bulb was fully protruded.

Francis M. Crage.

Rundle, F. F., and Wilson, C. W. **Development and course of exophthalmos and ophthalmoplegia in Graves'**

disease with special reference to the effect of thyroidectomy. *Clinical Science*, 1945, v. 5, Dec., pp. 177-194.

Measurements provide no support for the claim that exophthalmos may develop abruptly, even over night, and that it may vary greatly from day to day. Widening of the palpebral fissure from lid retraction may at times be rapid and create the illusion of increased exophthalmos. Measurements of ocular prominence were made with Hertel's exophthalmometer, modified by the inclusion of a central stop to give greater accuracy. The vertometer measured the range of elevation.

Stages of ingravescence and remission occur in the course of exophthalmos and related eye signs in Graves' disease. The former is called the dynamic and the latter the static phase. The dynamic precedes the static phase.

The exophthalmos develops at the rate of 0.5 mm. per month with a concomitant development of paralysis of elevation. The latter loses four to five degrees for each millimeter of protrusion. Exophthalmos and ophthalmoplegia are slower and less complete in their progressive stage.

The position of the globe depends on the volume of the orbital tissues. The orbital change is a true growth of tissue and the resultant exophthalmos, as indicated by the curves is of the same order in all cases, even after thyroidectomy. The increased exophthalmos after thyroidectomy is not due to excess thyroid hormone. It is merely evidence that the patient was probably in the dynamic phase of the disease. The orbital tissue growth seems to be produced by some nonthyroid hormone. After thyroidectomy for thyrotoxicosis, the exophthalmos and range of elevation of the eye showed little

change. When a slight increase in protrusion occurred it could be ascribed to recovery from loss of weight.

Francis M. Crage.

Sugar, S. H. and Forestner, H. J. **Methacrylic resin implant for sunken upper lid following enucleation.** *Amer. Jour. Ophth.*, 1946, v. 29, August, pp. 993-1000. (6 figures, references.)

Toni, S. S. **A case of anophthalmos.** *Manitoba M. Rev.*, 1946, v. 26, Feb., p. 73.

The author briefly relates the history of this developmental anomaly and presents his own case in which a bilateral anophthalmos was present in an otherwise normal child.

Francis M. Crage.

Wheeler, Maynard. **Exophthalmos caused by eosinophilic granuloma of bone.** *Amer. Jour. Ophth.*, 1946, v. 29, August, pp. 980-983. (2 figures, bibliography.)

Wolff, Eugene. **Hyaline bodies in the intraocular fluids and tissues.** *Trans. Ophth. Soc. U. Kingdom*, 1944, v. 64, p. 179.

The author describes hyaline-like bodies that are found in the intraocular fluids and tissues and are derived from the blood. Some called hemoglobin bodies, stain bright pink with eosin and are usually formed by a clumping together of about 25 red cells. They occur in the aqueous and vitreous in acute and subacute inflammations associated with hemorrhage. They are not nucleated but may engulf a cell, a nucleus, or any solid matter such as pigment.

Fibrin bodies typically are rounded bodies. They may be much smaller than a red cell or four to five times as

large. They may not be strictly circular but their margin is not as irregular as that of a hemoglobin body. The bodies may settle on the internal limiting membrane and become hemispherical. In early stages they stain pink, as they grow older they take on the blue (basophilic) stain and eventually they may become calcified. They may be surrounded by cells. They are more often seen in acute and subacute inflammations than in chronic.

The author distinguishes both types from Russell bodies which are hyaline spherules formed in chronic inflammatory conditions only in the presence of plasma cells. In the eye they are found in the iris, ciliary body, choroid, retina, and conjunctiva. Beulah Cushman.

Woods, A. C. **The ocular changes of primary diffuse toxic goiter.** *Medicine*, 1946, v. 25, May, pp. 113-154.

This comprehensive review discusses, in great detail, the usually noted ocular changes of primary toxic goiter. In the first section, all of the lid signs are described, and the author explains each one, in terms of the relationships between relaxation of the orbicularis muscle, overaction of the levator muscle and increased tone of the palpebral smooth musculature. The last mentioned factor is a logical one, in view of other evidences of sympathicotonia in toxic goiter.

Under the heading of external ocular changes, the author discusses weakness of convergence (Moebius' sign), abnormal pigmentation of the skin of the lids (Jellinek's sign), adrenalin-sensitized pupils (Loewi's sign), and excessive lacrimation.

Two types of patients with extraocular muscle palsies are described. The patients in the first group have

isolated or multiple pareses, with no definite pattern of involvement. These occur with exophthalmos, and disappear when the thyrotoxicosis is controlled. Organic changes analogous to those of myasthenia gravis are sometimes found in these muscles. However, there is no favorable response to prostigmine. In the other type ocular-muscle palsies occur in "malignant exophthalmos," or "exophthalmic ophthalmoplegia." The muscle changes progress even after thyroidectomy. The muscles show hypertrophic myositis, fibrosis and edema. This condition has been related to postoperative changes in pituitary function, and treatment must include thyroxin and iodine.

Exophthalmos is seen in 65 percent of patients with primary diffuse toxic goitre. Reports are cited to indicate that the exophthalmos does not regress after the thyrotoxicosis is controlled. The pathogenesis of the exophthalmos is discussed and the importance of the following factors is evaluated.

Hypertrophy of orbital contents, particularly orbital fat is considered important. Relaxation of the rectus muscles, allowing the eye and orbital contents to protrude is probably not an important factor, since the role of the obliques is not satisfactorily explained. The importance of contraction of smooth muscle of the orbit is difficult to accept, since the orbital smooth muscle is vestigial in man. Edema of the orbital contents has been substantiated as a factor in exophthalmos. Orbital vasodilatation has not been proved to be a causative factor. Degenerative myositis, with increase in muscle size, can be at best only an inconstant cause of exophthalmos, since it is not uniformly present.

The action of the anterior pituitary

hormone probably plays a part. The work of Mulvany is discussed. The author concludes that although there appears to be a relationship between the exophthalmos and the anterior pituitary, its exact nature is as yet unknown.

Benjamin Milder.

14

EYELIDS AND LACRIMAL APPARATUS

Cristini, G. Myoblastoma of the lid. *Rassegna Ital. d'Ottal.*, 1946, v. 15, May-June, pp. 207-223.

The dual nature of muscular tissue gives rise to the terms of leiomyoma and rhabdomyoma, depending upon whether the newgrowth is composed of smooth or striated muscle. The tumor described by Cristini was found in the lower lid of a woman 57 years of age and was classified as myoblastoma. It is the sixth one to be reported. The tumor develops slowly and insidiously and presents no characteristic clinical picture. Histologically the case is interesting because of the great variety of cell types and the complexity of structural features. Various phases of differentiation and maturation of the primitive myoblastoma to the fibrocellular striated muscle are seen. (5 figures, bibliography.)

Eugene M. Blake.

Dobyns, B. M. Studies on exophthalmos produced by thyrotropic hormone. *Surg., Gynec., and Obst.*, 1946, v. 82, March, pp. 290-300, May, pp. 609-617, June, pp. 717-722.

This study was undertaken to investigate the changes in the prominence of the eyes induced by the administration of various preparations of thyrotropic hormone and to correlate the exophthalmos with various tissue

changes. In normal guinea pigs, thyroidectomy caused an increase in the prominence of the eyes. The intercorneal distance was used as a measurement of exophthalmos. At varying time intervals after the operation the following pituitary preparations were given and the exophthalmos measured. After antuitrin T definite exophthalmos occurred. After the purified thyrotropic product hyperplasia was noted but little or no exophthalmos. The crude extract produced an exophthalmos greater than the last drug but less than the first, and it also caused thyroid hyperplasia. The specific metabolic principle did not produce exophthalmos. Half the animals were castrated, which did not influence the development of exophthalmos. The antuitrin T produced gross and microscopic changes in the connective tissue in the orbit and elsewhere in the body. The fat deposits were depleted and partially replaced by a gelatinous material. Plasma fat and blood acetones were elevated and there was a polymorphonuclear leucocytosis. Skeletal and cardiac muscle fibres lost their striations and were found to contain multitudes of fat droplets. The theoretical and clinical significance of the micro-pathologic changes are discussed. (17 illustrations, 4 tables, references.)

Bennett W. Muir.

Grönvall, Herman. A case of supernumerary caruncula lacrimalis. *Acta Ophth.*, 1944, v. 22, pt. 2, pp. 158-165.

A case of supernumerary caruncle in a seven-year-old child is reported. Because it apparently caused a sensation of chafing in the eyes, and consequent grimacing it was excised and found to have the histologic structure of a normal caruncle. A tabulated review of seven cases reported in the literature

is given and the pathogenesis discussed. (3 illustrations.) Ray K. Daily.

Lodge, W. O. **Observations on the eyelids.** J. Internat. Coll. Surgeons, 1946, v. 9, May-June, pp. 383-378.

The author mentions some forty affections of the lids. Spastic entropion may sometimes be cured by painting the lower lids with colodion. For paralytic ectropion he exposes the internal palpebral ligament and the frontal process of the zygomatic bone. A 0.003-inch tantalum wire is inserted horizontally through the lower lid and attached to the areas exposed. He uses a similar wire in the Motais and Hess types of operation for ptosis. (4 figures.)

I. E. Gaynon.

McArthur, G. A. D. **Some notes on West's operation (endonasal dacryocystostomy).** Med. Jour. Australia, 1946, v. 1, April 13, pp. 508-510.

The author describes his technique of endonasal dacryocystostomy. He removes a small portion of the medial wall of the sac through the frontal process of the maxilla. Failure occurs when the sac is too small, an inadequate opening is made, and if there is stenosis of the junction of the canaliculus and sac. Of 42 operations 35 were successful.

I. E. Gaynon.

Stenbeck, Anna. **A follow-up of dacryocystorhinostomies.** Acta Ophth., 1944, v. 22, pt. 1, pp. 27-35.

This is an analysis of the surgical experience at the Sabbatsberg Hospital during the five-year period from 1936 to 1941. One hundred and seventy external operations were performed, of which 134 could be followed. In 116 cases the lacrimal passages were patent on irrigation, and 18 were impermeable. Most of the patients with patent

lacrimal passages had no symptoms. A few had epiphora only in the wind. Five had constant epiphora; in two of these the lower canaliculus was obstructed before the operation; one had a hyperplastic rhinitis, and in two the continuous epiphora in spite of patency of the lacrimal passages could not be explained. Of the 18 cases impermeable to irrigation 15 were normal when discharged, 3 developed obstruction shortly, 6 after two months, and 5 about one and one half years after the operation. In one patient the canal was patent for five years, when conjunctivitis, followed by an infection in the sac, resulted in an obstruction with dense tissue. In three patients the data on the recurrence of symptoms could not be established. Three patients were operated upon a second time, one externally and two intranasally; the connective tissue blocking the lacrimonasal opening was removed. A division of the material into four groups shows satisfactory results in 79.4% of stenosis, 87.8% of dacryocystitis, 73% of phlegmons, and 33.3% of pericystitis. It appears that the prognosis is best in dilated sacs, regardless of their content. Because the immediate post-operative results are better than the final, it is important to follow the patients for some time.

Ray K. Daily.

Svoboda, J. **Surgical treatment of lacerations of the lower lacrimal canals.** Lekarske Listy, 1946, v. 1, July 1, pp. 307-308.

Lacerations of the lower lacrimal canaliculus were corrected with the aid of the following operation in 53 patients. A probe-like wire is passed through the disrupted canal, after sutures have been placed in the conjunctiva but not tied. Then the edges of the laceration are stitched together

and the knots tied. It is important that the wire enters the nasolacrimal duct. The wire is retracted gradually during the postoperative period.

O. Felsenfeld.

Thygeson, Phillips. **The etiology and treatment of blepharitis: a study in military personnel.** *Military Surg.*, 1946, v. 98, March, pp. 191-203.

Blepharitis was the most common external eye infection seen in military personnel. Laboratory and clinical studies of 350 cases of blepharitis indicate that the three important types are the staphylococcic, the seborrhoeic blepharitis, and the diplobacillary. Staphylococcic blepharitis is often unilateral, and is often associated with chalazion, hordeolum, and ulceration. It is characterized by small hard scales, which are tenacious and difficult to remove. An associated keratoconjunctivitis is almost the rule. Temporary or permanent loss of cilia, and associated otitis externa, impetigo, sycosis barbe and acne vulgaris are common. There is burning, itching, and photophobia.

With seborrhoeic blepharitis, there is seborrhea capitis, and usually an associated seborrhoeic dermatitis of brow and ears, the lesion is always bilateral, nonulcerative, and squamous, the scales are greasy and easy to rub off, and associated conjunctivitis is minimal if present. There are no complicating inflammations. The skin gives evidence of increased seborrhea, discomfort is minimal.

Diplobacillary blepharitis is characterized by maceration of the skin at the inner and outer canthus, and associated conjunctivitis. The infection is superficial, there is no ulceration, and no inflammation of the Meibomian glands.

The finding of budding yeast forms,

pityrosporum ovale, was considered diagnostic of seborrhoeic blepharitis. Routine bromoscopic examinations of the lid margin in chronic conjunctivitis revealed a high incidence of mild and subclinical blepharitis, usually staphylococcic. There is no evidence that vitamin deficiency, refractive error or allergy play significant roles.

I. E. Gaynon.

Torti, M. **Congenital lacrymal fistula.** *Rassegna Ital. d'Ottal.*, 1946, v. 15, no. 1 and 2, p. 69.

Torti describes two cases of unilateral fistula of the lacrymal sac, one of which was definitely of congenital origin, the other probably inflammatory in nature. His conclusions are based upon histological studies of the excised tissue. Congenital fistula is caused by a supernumerary canaliculus and arises at the same period of development as the canaliculi. (4 figures.)

Eugene M. Blake.

15

TUMORS

Blake, E. M. **Cultivation of human tumor in the anterior chamber of the guinea-pig's eye.** *Amer. Jour. Ophth.*, 1946, v. 29, Sept., pp. 1098-1106. (8 figures, references, discussion.)

Blegvad, Olaf. **Myxoma of the orbit.** *Acta Ophth.*, 1944, v. 22, pt. 2, pp. 131-140. (See section 13, Eyeball and orbit.)

Byrn, Willy. **Three cases of hemangioma of the subconjunctiva.** *Acta Ophth.*, 1944, v. 22, pt. 2, pp. 166-175. (See Section 5, Conjunctiva.)

Cristini, G. **Myoblastoma of the lid.** *Rassegna Ital. d'Ottal.*, 1946, v. 15, May-June, pp. 207-223. (See Section 14, Eyelids and lacrimal apparatus.)

Godtfredsen, Erik. **Choroid metastases in chorionepithelioma of the testicle.** *Acta Ophth.*, 1944, v. 22, pt. 3, pp. 300-310. (See Section 7, Uveal tract, Sympathetic disease and aqueous humor).

Godtfredsen, Erik. **The frequency of secondary carcinomas in the choroid.** *Acta Ophth.*, 1944, v. 22, pt. 4, pp. 394-400. (See section 7, Uveal tract, sympathetic disease, and aqueous humor.)

Godtfredsen, Erik. **Ophthalmologic and neurologic symptoms of malignant naso-pharyngeal tumors.** *Acta Ophth.*, 1944, supplement 22, pp. 373.

This exhaustive monograph is based on a review of the literature and on a study of 454 case histories from the largest radiologic clinics of Denmark and Sweden, during the period from 1927 to 1942. The clinical symptoms are described in great detail. Of interest to the ophthalmologist are the patients with ophthalmoneurologic symptoms, which constitute 38 percent of this material. Usually these symptoms appear early if they appear at all. The nerves most frequently involved were the fifth cranial nerve and the eye nerves, separately or jointly. Half of the ophthalmoneurologic patients presented purely ophthalmologic symptoms, such as muscle paralysis, optic tract lesion, exophthalmos, and Horner's syndrome. These findings indicate that a malignant naso-pharyngeal tumor should be suspected in the presence of these symptoms, even if local nasopharyngeal symptoms are absent. In these patients there was an average period of 11 months between the onset of symptoms and a correct diagnosis. An exhaustive examination of the nasopharynx should lead to an earlier diagnosis, earlier institution of proper treat-

ment, and a better prognosis. An analysis of microscopic preparations in 458 cases reveals a difference between those with and without ophthalmoneurologic symptoms. The former contain a relatively greater number of squamous-cell carcinomas and cylindromas, and a smaller number of plasmocytomas and lymphosarcomas than the latter.

The therapeutic results show that sarcomas and lympho-epitheliomas are fairly radio-sensitive, and that with modern radiation therapy 22 percent of patients were free from symptom for five years, and three fourths of all become free from symptom after treatment. (53 illustrations, 30 tables.)

Ray K. Daily.

Penido Burnier and Salles Monteiro. **Teratoma of the orbit.** *Arquivos do Instituto Penido Burnier*, 1945, v. 7, Dec., pp. 114-128.

The authors found the subject dealt with merely in articles of the French and American encyclopedias of ophthalmology and in a few scattered articles in ophthalmologic reviews. They report the case of a two-months-old female child born at term, of normal birth. Three previous pregnancies had been normal and had been completed at term. There had been one spontaneous abortion at a few months, preceding the last completed pregnancy. The mother reported that the child had been born with the orbital tumor practically of the same size as it manifested at the age of two months. X-ray examination showed a great increase in size of the left orbit. Puncture at two different levels was negative. The puncture needle traversed trabecular areas sometimes of clayey consistency. After making the differential diagnosis from

hernias of cranial content, the tumor was successfully excised. It measured 6.2 by 6.0 by 4.5 cm., and weighed 92 gm. (10 illustrations, including 4 photomicrographs, references.)

W. H. Crisp.

Quintana, Juan. *Orbital Mixoma*. Arch. de la Soc. Oft. Hisp.-Amer., 1945, v. 5, May, pp. 346-351. (See Section 13, Eyeball and orbit.)

Zeeman, W. P. C. The diagnosis of a flat sarcoma of the choroid and the histological substratum of the changes observed with the ophthalmoscope. Acta Ophth., 1943, v. 21, pts. 1-2, pp. 47-60. (See Section 7, Uveal tract, Sympathetic disease and aqueous humor.)

16

INJURIES

Alvis, Bennett Y. The use of the Berman locator in removal of intraocular foreign bodies. South. Med. Jour., 1946, v. 39, Feb., p. 125.

This instrument has helped to differentiate a magnetic from a non-magnetic foreign body, to locate a magnetic foreign body, and to follow its changing position during the course of its removal.

Seven cases are briefly described and discussed. Important surgical details are mentioned and the exact localization of the foreign body is reported, at times with an accuracy so great as to obviate the need to introduce the magnet's tip into the vitreous.

The size of the foreign body and its distance from the locator has a definite influence on the latter's response. Posteriorly located small foreign bodies bring a response if the globe is rotated

so as to shorten the distance between the locator and the foreign body.

F. M. Crage.

Bertotto, E. V. *Symblepharon with serious effect on motility*. Anales Argentinos de Oft., 1945, v. 6, July-Aug.-Sept., pp. 98-100.

After an injury to the left eye by a machine-screw, conjunctival synechiae formed which prevented movement of the eye inward and upward. As a result, diplopia manifested itself in these directions of gaze. After two operations to relieve the symblepharon the diplopia disappeared and normal ocular motility returned. Edward Saskin.

Broendstrup, Poul. Two cases of temporary siderosis bulbi with spontaneous resorption and without impairment of function. Acta Ophth., 1944, v. 22, pt. 3, pp. 311-316.

In the first patient a small intraocular foreign body was discovered two years after the injury. The patient complained of failing vision and discoloration of the iris. There was incipient cataract and siderosis of the iris. The foreign body was not removed. The siderosis progressed for a few months, and then gradually receded until six years later when the color of the iris had become normal. Eleven years after the first examination the foreign body could not be demonstrated roentgenoscopically. The second patient, a man, 19 years of age, presented unmistakable clinical signs of an ocular perforation and pronounced siderosis of the iris without a history of trauma and without a demonstrable foreign body. In the course of 18 months he developed a mature cataract which was successfully needled. Fourteen years later all evidence of siderosis had disappeared.

It is pointed out that the result might be better if small intraocular foreign bodies were left to spontaneous absorption.

Ray K. Daily.

Brueckner, R. A case of thrombosis of the central retinal vein after a trauma. *Ophthalmologica*, 1945, v. 109, Apr.-May, pp. 203-211. (See Section 10, Retina and vitreous.)

Casanovas, J. Radiographic methods for the localization of foreign bodies of the visual apparatus. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, May, pp. 327-337. (See Section 1, General methods of diagnosis.)

Chamberlain, W. P. and Boles, D. J. Edema of cornea precipitated by quina-crine (atabrine). *Arch of Ophth.*, 1946, v. 35, Feb. pp. 120-134. (See Section 6, Cornea and sclera.)

Chulia, Vincente. A curious case of intraocular foreign body. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, May, pp. 368-370.

A large piece of steel had penetrated the cornea and lodged on the iris without damaging the lens. The foreign body was removed by means of iris forceps through a limbal incision.

J. Wesley McKinney.

Ciello, Alcides del. Ocular affections produced by poisonous animals and plants. *Arquivos Brasileiros de Oft.*, 1946, v. 9, Feb., pp. 10-21.

A brief recital of such disturbances, with a page of references.

W. H. Crisp.

Cruise, Richard. Preventable blindness in war. *Trans. Ophth. Soc. U. Kingdom*, 1944, v. 64, p. 165.

Modern warfare with explosives causes puncture wounds of the eyes, panophthalmitis, foreign bodies in the globe, lacerations of the cornea or sclera, prolapse of the iris, and concussion injuries to lens or retina. To prevent them the author presented a visor that consists of a perforated sheet of 22-gauge duralumin. It can be attached to the helmet and can be pulled down easily. Vision is not reduced by the visor. It weighs 0.395 lb. (13 illustrations.)

Beulah Cushman.

Filippi Gabardi, E. An electric needle for extraction of foreign bodies in the cornea. *Rassegna Ital. d'Ottal.*, 1946, v. 15, May-June, pp. 224-226.

The author describes an ingenious foreign body needle which does away with the need of an assistant. A slender tube containing a condensing lens and a light at the end is attached to a pocket flashlight battery by a flexible cord. At the light end of the tube a collar is affixed into which either a needle or gauge can be inserted. With this instrument the operator has a bright, condensed light and a foreign-body spud, and one hand free to separate the eyelids. (2 figures.)

Eugene M. Blake.

King, E. F., and Samuel, E. Fractures of the orbit. *Trans. Ophth. Soc. U. Kingdom*, 1944, v. 64, pp. 134-154. (See Section 13, Eyeball and orbit.)

Luz, B. da, and Sebas, S. R. Foreign body tolerated for eleven years. *Rev. Brasileira de Oft.*, 1946, 4th yr. June, no. 4, pp. 313-316.

The patient was a mechanic aged 40 years, the sight of whose right eye had been lost in consequence of penetration of the eye by a fragment of metal 11 years previously. He had

many periodic attacks of ocular and periorbital pain, varying in intensity. There was no light perception. In the enucleated eye the metallic foreign body was found embedded in the sclera 3 mm. behind the equator of the eye. The lens was absent, probably having been removed in an earlier operation to which the patient made vague reference. (References.) W. H. Crisp.

Marner, Else. A case of ocular chalcosis with spontaneous resorption of the copper and disappearance of chalcosis. *Acta Ophth.*, 1945, v. 23, pt. 2, pp. 171-174.

This is a follow-up report of a case reported by Kjerrumgaard in 1941. A 10-year-old boy had both eyes injured in 1937 by the explosion of a percussion cap. X-ray examination revealed two small metallic foreign bodies in each eye. Three years after the injury there was bilateral chalcosis. Eight years after the injury no foreign bodies could be demonstrated in the left eye by X ray, and the chalcosis in that eye had practically disappeared; there were only faint traces of the previously found disk-shaped central opacity on the anterior surface of the lens. The chalcosis on the right side persisted, but one foreign body was no longer visible. Ray K. Daily.

Pinkerton, O. D. Traumatic liporrhagia retinalis. *Arch. of Ophth.*, 1946, v. 35, Feb., pp. 176-178.

The history of a case of traumatic liporrhagia retinalis or Purtscher's disease in an 11-year-old Filipino boy is presented. The boy was struck by a vehicle. The injury consisted of a severe lacerated wound of the left temporal and frontal areas and the left external canthus, compound, comminuted, complete fracture of the left

zygoma, and contusions of both sides of the face, the chest, and the upper portion of the abdomen. Within six hours the vision of the right eye was limited to perception of light peripherally. A massive yellow extravasation with hemorrhages was observed in the fundus. Within a month there was complete absorption of the exudate and hemorrhage except for a small amount between the nerve head and macula. A marked pallor of the nerve developed. Vision was limited to counting fingers at three to four feet in the temporal and superior fields only. Abscess of the lung developed at a late date.

John C. Long.

Swanson, C. A. and Stewart, R. A. Causes of uniocular and binocular blindness in the U. S. Navy and U. S. Marine Corps in World War II. *Sight-Saving Review*, 1946, v. 16, Spring, pp. 36-46.

The treatment of ocular injuries during World War II were characterized by improved care mainly because of chemotherapy. Of 119 cases of bilateral blindness, 84 resulted from trauma, and 35 from medical causes. Methyl alcohol poisoning was the cause in 19 of the latter. Of 640 cases of unilateral blindness, 464 resulted from trauma. Two-thirds of the intraocular foreign bodies were magnetic. The Berman locator is useful in determining this fact. Foreign bodies up to 2 mm. in diameter usually leave a useful eye. Sympathetic ophthalmia occurred five times after removal of intraocular foreign bodies. I. E. Gaynon.

Uhde, G. I. Arsenical eye burns. *Amer. Jour. Ophth.*, 1946, v. 29, Sept., pp. 1090-1093. (5 figures.)

Uhde, G. I. Mustard-gas burns of

human eyes in World War II. *Amer. Jour. Ophth.*, 1946, v. 29, August, pp. 929-938. (6 figures, 7 tables.)

17

SYSTEMIC DISEASES AND
PARASITES

Arroyo, Manuel. **Onchocercosis and its ocular complications.** *Rev. Brasileira de Oft.*, 1946, 4th yr., June, No. 4, pp. 285-295.

The author summarizes the first classical report of a case as given by Rodolfo Robles, including the following symptoms: reddening of the conjunctiva; iritis; the formerly brilliant and transparent cornea becoming dull and without gloss; tiny leukomas (as though the patient had suffered from an ulcerative keratitis); constant headache and periorbital pain, and marked diminution of visual acuity. In honor of the distinguished ophthalmologist referred to, who died recently, the present author urges that the disease should be known as Robles's disease.

W. H. Crisp.

Arumi, J. **Subconjunctival cysticercus.** *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, May, pp. 339-345.

A case of a cyst that was excised and studied histologically is reported.

J. Wesley McKinney.

Brueckner, R. **A case of Sjögren's syndrome, successfully treated with Perandren.** *Ophthalmologica*, 1945, v. 110, July-Aug., pp. 37-42. (See Section 6, Cornea and sclera.)

Cassady, J. V. **Uveal blastomycosis.** *Arch. of Ophth.* 1946, v. 35, Feb., pp. 84-97.

A 64-year-old white man was first seen because of polyarthritis and

cutaneous lesions. During the course of severe and multiple systemic manifestations, a uveitis developed in the right eye. Posterior synechiae were present and a yellowish, tubercle-like nodule was seen at the pupillary margin of the iris and another at the base. Biopsy and culture of material from the cutaneous lesions yielded a fungus identified as *Candida parapsilosis*. Attempts to culture this organism from the aqueous were unsuccessful. The patient's condition grew worse and he died approximately one year after the onset of the joint symptoms. Autopsy showed extensive blastomycotic lesions in the skin, lungs, prostate, kidneys, bones, and eyes. Histologic study of the eye showed tubercles in the deep corneal abscesses, areas of necrosis, lymphocytes, plasma cells, epithelioid cells, and giant cells. Giant cells which had engulfed the double-contoured bodies of fungus, some of which were budding, were found throughout the mass in great numbers..

Should eye changes become apparent during the course of endogenous blastomycosis (Gilchrist's disease) the author suggests the withdrawal of the plasmoid intraocular fluid for cytologic examination and culture. (11 illustration.)

John C. Long.

Contino, F. **Surgical treatment of subretinal cysticercus.** *Rassegna Ital. d'Ottal.*, 1946, v. 15, May-June, pp. 165-181.

Since all attempts to destroy an intraocular cysticercus by medical means appear to be useless the treatment must be surgical. After reviewing all the methods employed to destroy the parasite within the eye, the author describes two eyes in which he succeeded in killing the cysticercus by means of diathermy coagulation with the Weve

technic. The treatment permitted the retention of the globe but vision was almost nil. (2 figures, bibliography.)

Eugene M. Blake.

Davenport, R. C. Ocular psychoneuroses. *Trans. Ophth. Soc. United Kingdom*, 1944, v. 64, p. 24.

The incidence of ocular psychoneurosis is difficult to estimate but patients may be roughly grouped in three divisions: those with an obvious organic defect that causes the symptoms; those with an inadequate organic basis for their troubles; and an intermediate group in which the patients have an organic lesion upon which an element of neurosis is overlaid.

The large majority of patients present enough of their personality for the ophthalmologist to make adequate judgment before he proceeds to treatment. Much of the judgment may be made as the history of the complaint is given.

The large majority of patients have hysteria or one of the anxiety states and squints afford a wide field for the assessment of the psychopathic factor.

A number of functionally blind were received after the retreat from Flanders and most of them recovered their vision after rest and reassurance, but night terrors persisted. Of four others sent to St. Dunstan's Hospital, three had one seeing eye and the fourth a large error of refraction. Conscious malingering was rarely found.

The author urges the importance of assessing the psychological factor in all eye patients.

Beulah Cushman.

Doggart, J. H. Ocular psychoneurosis. *Trans. Ophth. Soc. United Kingdom*, 1944, v. 64, p. 29.

The psychoneurotic patient with his lowered threshold for anxiety often

collapses with panic at the mere thought of failing sight; and fear, once it has gripped him, may be aggravated by the many menacing advertisements.

The commonest complaints in ocular psychoneurosis are failing vision, spots or flashes of light, intolerance of glares, double vision and difficulty in focusing, transient blurring, and aching of the eyes.

The author found that elaborate traps for the malingerers seldom justified the time expended, as most malingerers are stupid enough to give themselves away. The borderline between conscious pretense and psychoneurotic inhibition cannot always be established, and in any event no disciplinary action can be taken on a charge of foxing over test-types.

He concluded with Tostevin that ocular defects were seldom the primary cause of failure in air cadets. The author also believes that the correlation of the different branches of medicine which is generally desirable is particularly needed between neuropsychiatry and ophthalmology. The final disposal of serious problems should be left to the neuropsychiatrist.

Beulah Cushman.

Gillespie, R. D. Ocular psychoneurosis. *Trans. Ophth. Soc. United Kingdom*, 1944, v. 64, p. 41.

All the fundamental lessons of psychosomatic medicine can be applied to or deduced from functional disorders of the visual apparatus as its functions include sensation, voluntary movement, and involuntary movement of unstriated muscle.

The dependence of many ophthalmological tests upon willing co-operation of the patient gives scope for malingering but the infinite capacity of the human race for self-deception

makes the additional gift of malingering almost unnecessary.

The most used function may often be made abnormal by hysteria or anxiety neurosis. The only common hysterical disorders of eye movement, is failure to converge, based on a lack of desire to look. Failure to accommodate can also be hysterical.

Sixty-six air crews undergoing orthoptic treatment were subjected to psychiatric examinations and 40 were found to have in some degree the same characteristics that were found in air crews that broke down with frank psychoneurotic disorders.

Anxiety symptoms may arise in someone of average psychological constitution where external stress is great or motivation to fly is inadequate.

The author is not willing to go as far as some who say that the mentality of everyone who has heterophoria is abnormal. Beulah Cushman.

Grossman, E. E. **Conjunctivitis associated with erythema multiforme bullosa.** Amer. Jour. Ophth., 1946, v. 29, Sept., pp. 1146-1149. (References.)

Haar, M. **Reiter's disease.** Acta. Ophth. 1945, v. 23, pt. 2, pp. 143-150. (See Section 5, Conjunctiva.)

Haar, M. **Ophthalmomyiasis interna posterior.** Acta Ophth., 1945, v. 23, pt. 2, pp. 135-141.

The literature on 30 published cases is reviewed and a new case reported. While spending a vacation in the mountains a twelve-year-old boy developed an iridocyclitis of the right eye, and during the course of the disease a sharply circumscribed grayish white shiny body could be seen in the vitreous below and nasal to the papilla. It was interpreted as a larva of hypoderma

lineatum. The lens became dislocated. Within a year the media cleared, vision became normal, and the appearance of the larva indicated that it was being absorbed. Within that period the child had edematous swelling on the head and face, nodules on the scalp, and eosinophilia (15 percent). Spontaneous recovery, without removal of the larva is reported in one other case in the literature. Ray K. Daily.

Johnson, H. C. **Retinal venous sheathing in multiple sclerosis; report of a case.** Amer. Jour. Ophth., 1946, v. 29, Sept., pp. 1150-1151. (3 figures, references.)

Kravitz, Daniel. **Infections and reflex disorders of the eye from dental affections.** Amer. Jour. Ophth., 1946, v. 29, Sept., pp. 1135-1145. (References.)

Lech Junior. **Vanadium in ocular syphilis.** Arquivos do Instituto Penido Burnier, 1945, v. 7, Dec., pp. 204-211. (See Section 2, Therapeutics and operations.)

Milder, Benjamin, **The eye examination in the differential diagnosis of the disoriented patient.** Amer. Jour. Ophth., 1946, v. 29, August, pp. 953-967. (2 tables, references.)

Morgan, O. G. **Ocular psychoneurosis.** Trans. Ophth. Soc. United Kingdom, 1944, v. 64, p. 52.

The author describes several patients with self-inflicted artefact conjunctivitis who responded to psychotherapy. Beulah Cushman.

Prezidio de Figueiredo, Nicanor. **A case of ocular avitaminosis.** Rev. Brasileira de Oft., 1946, v. 4, June, pp. 317-324.

A man of 26 years, in an artillery encampment, showed chronic irritation to which the author gives the title "blepharokeratoconjunctivitis." Failure of previous modes of treatment, and marked improvement under a Brazilian vitamin preparation, convince the author that the ocular disturbance was due to deficiency in riboflavin.

W. H. Crisp.

Richards, J. M. and Romaine, H. H. **Keratoconjunctivitis sicca.** Amer. Jour. Ophth., 1946, v. 29, Sept., pp. 1121-1125. (7 figures, references.)

Rundle, F. F. and Wilson, C. W. **Development and course of exophthalmos and ophthalmoplegia in Graves' disease with special reference to the effect of thyroidectomy.** Clinical Science, 1945, v. 5, Dec., pp. 177-194. (See Section 13, Eyeball and orbit.)

Saenz Canales, José. **The vitreous body in some ocular localizations of the cysticercus.** An. de la Soc. Mexicana de Oft. etc., 1945, v. 20, April-June, p. 55.

Much of the article is taken up with a discussion of vitreous structure, and of the literature of the subject since Graefe, who in his Archiv gave an excellent description of the ophthalmoscopic appearance. The author of the present article gives a review of the ophthalmoscopic appearance in sub-retinal localization of the cysticercus, including the innumerable glistening crystals whose appearance varies with every movement of the vesicle. A little later come the spots commonly associated with the names Liebreich and Cirincione. These are roundish spots of variable size, comparable to little drops of dirty oil, or to the precipitates of

descemetitis. Pseudomembranes frequently follow. The various stages of disintegration of the vitreous are attributed by the author to inflammation, degeneration, and allergy. (Four photomicrographs, references.)

W. H. Crisp.

Sardana, M. N. **Ocular manifestations of avitaminosis in adults.** Indian Med. Gazette, 1946, v. 81, p. 188-193.

Five hundred cases of avitaminosis with ocular symptoms were observed in 1943 at the Indian Prisoners of War Hospital in Singapore under Japanese occupation. Under the circumstances the methods of diagnosis and treatment were meager. Treatment consisted of the feeding of rice polishings, rice water, red palm oil, and marmite.

Vitamin A deficiency was found in 159 patients. The chief complaints were night blindness and itching and dryness of the eyes. The cornea was insensitive in 81 percent of the patients, there were corneal ulcers in 2 percent, disciform keratitis in 2 percent, and blepharitis in 5 percent. The pupils were dilated and visual acuity was impaired.

Deficiency of vitamin B₁ was found in 220 patients. They complained of decreased vision, photophobia, and of a burning sensation. The pupils were normal in size, reacted well to light, and were sluggish in accommodation. The fields were slightly contracted and two percent of the patients had optic nerve atrophy.

The 121 patients who had deficiency of riboflavine complained of hazy vision in the sun. The pupils were slightly dilated and reacted sluggishly to light. The visual acuity was reduced, accommodation was normal, and the fields were contracted in the upper and temporal regions.

I. E. Gaynon.

Skydsgaard, Henning. **Polyarthrititis urethritica simplex with eye symptoms. (Reiter-Freunds syndrome).** *Acta Ophth.*, 1943, v. 21, pts. 1-2, pp. 107-118.

Four cases are briefly reported. The characteristic feature of this syndrome is the non-gonorrheal triad of urethritis, conjunctivitis, and arthritis. The conjunctivitis is the least conspicuous of the symptoms. This syndrome should be kept in mind when dealing with purulent conjunctivitis of unknown etiology, and in the differential diagnosis of exogenous gonorrheal conjunctivitis. Ray K. Daily.

Souza Queiroz, Leoncio de. **Ocular cysticercosis.** *Arquivos do Instituto Penido Burnier*, 1945, v. 7, Dec., pp. 129-150.

From 1913 to 1945, a total of 92 cases of ocular cysticercosis have been recorded in the Penido Burnier Clinic. The statistics relating to these cases are analyzed. They include subconjunctival, cysticercus of the anterior segment, of the vitreous, and subretinal. Other phases of the subject dealt with are the reaction of the complement fixation for cysticercosis, prognosis and prophylaxis, and treatment. A typical case of subretinal cysticercus in a woman of 28 years is detailed. The cyst was in the nasal sector, was located by diathermy puncture, and was extracted with very slight traumatism. Vision returned from 0.3 to normal. (12 illustrations, elaborate analytical statistical table, bibliography.)

W. H. Crisp.

Stewart, D. S. **Ocular psychoneurosis.** *Trans. Ophth. Soc. United Kingdom*, 1944, v. 64, p. 54.

The author reviewed the histories of 131 patients who complained of head-

aches in a group of 231 psychoneurotic patients. He feels that every patient consulting an oculist is in a state of "eye consciousness." To succeed in unmasking a malingerer by optical trickery is creditable in so far as it helps to exclude an organic cause for the pretended amblyopia or spastic strabismus, but to dismiss the patient harshly without further consideration is as unsuitable as to kick away the crutches from a cripple.

Beulah Cushman.

Traquair, H. M. **Ocular psychoneurosis.** *Trans. Ophth. Soc. United Kingdom*, 1944, v. 64, p. 37.

The symptoms of the psychoneurotic eye patient are characterized by inconsistency in themselves and are not justified by the physical findings.

The diagnosis and treatment go together. As the diagnostic measures are carried out they impress the patient and pave the way for successful treatment. The study of the binocular visual field and of the field of vision of each eye separately are among the most useful tests. They should be repeated at 2 M.

The author feels that the chief cause of the psychogenic visual symptoms is fear and personal maladjustment. The chief elements in treatment are explanation, distraction, encouragement and "therapeutic conversation."

Beulah Cushman.

Weskamp, C. **Ocular syphilis.** *Anales Argentinos de Oft.*, 1945, v. 6, Apr.-May-June, pp. 47-52.

The first part deals with generalities. This section is devoted to a discussion of extraocular syphilitic lesions and their therapy with arsenic, bismuth, and malaria.

The second part deals with specific

ocular syphilis. Primary optic atrophy is a result of neurosyphilis, and appears from 10 to 20 years after the initial lesion. It is frequently accompanied by the Argyll-Robertson pupil. Interstitial keratitis is the other sign that is virtually indicative of syphilis. Treatment of ocular syphilis depends upon the location of the lesion and the duration of the disease. Lesions that involve mesodermal structures in the iris, the choroid, and the sclera, respond to bismuth, arsenic, mercury. Lesions in the neural ectoderm such as optic atrophy, require fever therapy. The author describes penicillin as a new potential antiluetic measure.

Edward Saskin.

Winnicott, D. W. Ocular psychoneurosis. Trans. Ophth. Soc. United Kingdom, 1944, v. 64, p. 46.

The author gives an account of the ocular psychoneuroses of childhood. He asks for belief in the matter of the reality of feelings in a child and as an example quotes the experience of a friend whose childhood was spoilt by the remark of an eye surgeon. He told the child's mother in her presence that she has retinitis pigmentosa and would probably become blind. The child spent her childhood expecting blindness and did not begin to realize until she was 50 years of age that the surgeon was wrong. Children feel that they are the custodians of any part of their bodies and if they fail to keep their eyes healthy they feel they have failed in a trust.

Three groups of psychological symptoms are recognized: those shown by children whose personality structure is satisfactory; those that are associated with depression; and those associated with a defect of the structure of the personality.

Glasses quickly acquire a meaning to the child who wears them as they become part of the personality of the child.

Hysterical blindness is associated with guilt about seeing.

Depression in childhood is recognized as a mood and appears clinically in its form of common anxious restlessness or of a denial of depression by forced activity and liveliness. Along with this there are self destructive actions, deliberate or accidental, and also hypochondriacal worry over the body or its parts. Depression is very common among children and hypochondriacal worry joins with normal concern.

Hypochondria of the mother must be distinguished from that of the child. True reassurance comes from statement of facts.

Squint can have a purely psychological cause and the author describes three types: an external squint in which the two eyes do not work with one aim, and that is associated with a division in the personality; convergence that can be likened to thumb sucking; and a type that accompanies a phase of acute introversion.

Beulah Cushman.

Woods, A. C. The ocular changes of primary diffuse toxic goiter. *Medicine*, 1946, v. 25, May, pp. 113-154. (See Section, 13, Eyeball and orbit.)

18

HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Cordes, F. C. Ophthalmology's post war responsibilities and opportunities. *Jour. Amer. Med. Assoc.*, 1946, v. 131, Aug. 24, pp. 1395-1397.

A three or four year residency at a medical center is ideal. A basic course

of six or eight months followed by a year or more of carefully supervised clinical work will help to make a safe ophthalmologist. Training may also be acquired through preceptorship and association in private practice with a qualified ophthalmologist. The basic course plus supervised reading, as outlined in the home study course, is essential. A number of three-year residencies and refresher courses should be arranged for training of men from Central and South America.

I. E. Gaynon.

Harrowes, W. M. Psychological reactions in war blinded. *Brit. Med. Jour.*, 1946, no. 4464, July 26, pp. 129-130.

Forty patients were studied. All had a retrospective flattening out of a reactive depression. Thirty-five percent developed a classical tension depression characterized by fault finding, uncooperativeness, undue slowness of learning, and rejection of all suggestions. One patient over-compensated and the others gradually became stabilized.

I. E. Gaynon.

Hinshaw, J. H. Legal ophthalmology. *Amer. Jour. Ophth.*, 1946, v. 29, Sept., pp. 1112-1118. (Discussion.)

Lech Junior. Twenty-five years of activity of the Penido Burnier Institute. *Arquivos do Instituto Penido Burnier*, 1945, v. 7, Dec., pp. 5-29.

With ample statistics, and 12 architectural and personal photographs, this 25-page article reviews the history of the institution.

W. H. Crisp.

Pinson, E., and Chapanis, A. Visual factors in the design of military aircraft. *J. Aviation Med.*, 1946, v. 17, April, pp. 115-122.

In a study by the Air Technical Service Command, the importance of diurnal visual acuity, depth perception, visual fields, and night vision are recognized. Aircraft should be designed so as to allow these human factors to be at their maximum efficiency. The importance of mechanical design, and of improved optical materials and their use, is stressed. (5 figures, 2 tables, references.) Bennett W. Muir.

Rochon-Duvignon A. and Aubaret. Jacques Daviel: His life and the discovery of cataract extraction. *Ann. d'Ocul.*, 1946, v. 179, Jan., pp. 1-23.

Monday, April 8, 1745, was an epoch-making day in ophthalmology. A small man of about fifty had successfully performed the first complete cataract extraction in history. This issue of the *Annales* commemorates the two hundredth anniversary of this great event and is largely dedicated to the memory of the father of French ophthalmology.

Daviel conceived the need of a complete cataract extraction about 1741, when he unsuccessfully performed a bilateral reclinatio for cataract on the eyes of the hermit of Aguires. In the second eye fragments of the lens cortex fell into the anterior chamber and this occurrence prevented his pushing the lens backward and downward into the vitreous. He apparently knew that Petit had previously removed dislocated lens matter from the anterior chamber through an incision at the lower limbus.

His first three operations, reported in 1743, were performed with a bistoury-like knife, a needle, and a probe-like instrument on a handle. Four years of effort and experiment resulted in his improved technique. An incision was made in the lower part of the limbus

with a straight keratome-like knife and enlarged with a curved scissors. The capsule was then opened with a cutting needle, the precursor of the modern cystotome. Through a round pupil the lens was expressed into the anterior chamber from which it was removed with a spoon which still bears his name.

In the following 11 years Daviel reported having performed 354 cataract extractions of which 305 were successful. Among his royal patients were the Royal Princess Palatine and King Ferdinand VII of Spain. Louis XV of France, interested, ordered him to operate on the eyes of a dog, after which he made him oculist to the King.

Daviel was born in Normandy between 1693 and 1696. After completing his medical studies at Hotel Dieu in Paris, he began practicing in Marseilles. When an epidemic of plague had become catastrophic in the Toulon area Daviel volunteered for medical service there, and was cited for his work, courage, and devotion to duty. Upon returning to Marseilles, an attempt to rescind his hospital appointment was made by the city officials for medico-political reasons. At about that time he took up ophthalmology. In 1744 he moved to Paris where he practiced until shortly before his death. In 1762 Daviel developed laryngeal paralysis. He went to Geneva because of his health and there he died September 30, 1762, where his body still remains.

Charles A. Bahn.

Smith, V. M. **Rehabilitation of the partially seeing.** *Sight-Saving Review*, 1946, v. 16, Spring, pp. 31-35.

Evaluation of eyesight should be based on the central visual acuity of each eye, binocular vision, muscle action, peripheral vision, and color

vision. Illumination should be adequate, and free from glare. Work should be arranged to prevent ocular fatigue and should be selected with consideration of the patient's disability. Braille should not be taught until it is necessary. The ophthalmologist should recommend in his report what the patient may do. I. E. Gaynon.

19

ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Katzin, H. M. **Photography of the external eye.** *Arch. of Ophth.*, 1946, v. 35, May, pp. 514-518.

Photographic reproduction of the eye has become an indispensable part of teaching, research, and medical records. The mechanical problems involved are different from those found in general photography or photomicrography because the eye is neither gross nor microscopic in size. The problems are really those of low power photomicrography. Further, because of the problem of blinking, particularly in photophobic eyes, the light source should be synchronized with the shutter of the camera, and the time of exposure must be minimal. Many types of cameras have been used for this purpose.

A discussion of the film, lenses, depth of focus, focusing, and lighting is given and the camera setup used by the author is described.

R. W. Danielson.

Stone, L. S. **Return of vision in transplanted adult salamander eyes after seven days of refrigeration.** *Arch. of Ophth.*, 1946, v. 35, Feb., pp. 135-144. The adult eye of the salamander may be transplanted with a return of vision. A new lens is regenerated from the

dorsal pupillary margin of the iris and a new retina from the undegenerated ciliary margin of the old retina. Seventy enucleated eyes of the adult salamander, *Triturus viridescens*, were refrigerated at a temperature of from 0 to 8°C. in sterile Ringer solution for periods ranging from two to fourteen days and were then transplanted into freshly denuded orbits of new hosts. After two days of refrigeration at 8°C. some of the eyes eventually became normally functioning organs. Refrigeration for longer than two days required a lower temperature (4 to 6°C.) to insure survival of the graft and successful transplantation. Eyes isolated as long as seven days at this temperature were successfully grafted, and return of vision was demonstrated a little over three months after they were transplanted. These eyes remained functional and were normal in appearance one year after they were grafted.

John C. Long.

Warkany, J. and Schraffenberger, E.
Congenital malformations induced in

rats by maternal vitamin A deficiency. Arch. of Ophth., 1946, v. 35, Feb., pp. 150-169.

When female rats were raised and bred on a dietary regimen which leads to extreme vitamin A deficiency during pregnancy, congenitally deformed offspring were obtained. There were various defects of the skeleton and some defects of the soft tissues. Sections of the eyes showed a fibrous retrolenticular membrane in place of the vitreous in every specimen. In addition there were frequently colobomas, eversion and abnormal structure of the retina, rudimentary development of the iris and of the ocular chambers, defects of the cornea and of the conjunctiva and lack of fusion of the lids. These congenital abnormalities consisted partly of structures arrested in early ontogenetic stages and partly of formations that do not correspond to normal embryonic conditions. When the maternal diet was supplemented with vitamin A during pregnancy, the eyes of the young were normal. John C. Long.

NEWS ITEMS

Edited by DONALD J. LYLE, M.D.
904 Carew Tower, Cincinnati 2

News items should reach the editor by the twelfth of the month

DEATHS

Dr. Carl Bishop, Plainville, New Jersey, died July 27, 1946, aged 46 years.

Dr. Joseph Marie Louis Bruno, Brooklyn, New York, died July 14, 1946, aged 52 years.

Dr. Phillips Eagleton, Newark, New Jersey, died September 11, 1946, aged 80 years.

Dr. Charles Willard Geiger, Kankakee, Illinois, died July 19, 1946, aged 75 years.

Dr. Gaylord Crawford Hall, Louisville, Kentucky, died June 16, 1946, aged 66 years.

Dr. Thomas D'Arcy McGregor, Buffalo, New York, died July 14, 1946, aged 52 years.

Dr. Joseph Louis Nocentini, Philadelphia, Pennsylvania, missing in action January 12, 1944, determined dead June 13, 1945, aged 34 years.

Dr. Robert Von der Heydt, Chicago, Illinois, died September 18, 1946, aged 71 years.

MISCELLANEOUS

The first international fellowship to be granted by The Eye-Bank for Sight Restoration, Inc., 210 East 64th Street, New York 21, has been announced by Mrs. Henry Breckinridge, executive director.

The candidate, chosen because of his outstanding qualifications, to be awarded this fellowship is an ophthalmologist of the Hebrew University in Palestine. He will receive post-graduate training in ophthalmology and research work in problems relating to the cornea at the Wilmer Institute, Johns Hopkins University, Baltimore, Maryland.

Dr. Grant Balding, 117 East Colorado Street, Pasadena, California; Dr. Paul L. Cusick, 1108 Stroh Building, Detroit, Michigan; Dr. Frederick C. Cordes, 384 Post Street, Dr. Max Fine, 350 Post Street, San Francisco, California, and Dr. L. Connor Moss, 1710 Rhode Island Avenue, N.W., Washington, D.C., have been named consultants in ophthalmology to the Secretary of War.

Major Gen. Norman T. Kirk, the Surgeon General of the Army, under whose direction the Armed Services medical consultant program was initiated during the war, said that the appointment of civilian consultants will augment the Army staff of doctors caring for soldier patients, and will evaluate, promote, and improve, wherever possible, the quality of medical care given American soldiers.

The state committee on ophthalmology has recommended to the house of delegates of the Minnesota State Medical Association that an eye bank be established. This eye bank will be similar to the Eye Bank for Sight Restoration, Inc., in New York, and the one in Cook County Hospital, Chicago.

Each Thursday during October, Dr. Byron Smith gave a lecture on "Ophthalmic plastic surgery" at the Manhattan Eye, Ear, and Throat Hospital, 210 East 64th Street, New York 21.

La Sociedad Cubana de Oftalmologia is looking forward to the third Pan American Congress to be held in Havana in February, 1948, under the auspices of the Cuban government. A movement for the foundation of a League Against Blindness is headed by the wife of the president of the Republic. Work has already begun on a hospital for the treatment of eye diseases among the poor. The foundation stone of the building has been laid, and it is hoped the building will be finished and functioning perfectly by the time the Congress convenes in Havana.

The Alabama Sight Conservation Association has recently donated \$10,000 to the Department of Ophthalmology of the Medical College of Alabama, to provide equipment for the University Eye Clinic. The Alabama Sight Conservation Association was originated and is sponsored by the Lions Clubs of Alabama.

SOCIETIES

Among the special guests taking part in the program of the American Academy of Ophthalmology and Otolaryngology at the Palmer House, Chicago, October 13th to 18th were: Dr. James B. Brown, St. Louis; Raymond Carhart, Ph.D., Evanston, Illinois; Mr. Howard Carter, Chicago; Helen Goodell, New York; Dr. Fremont C. Hall, Chester, Pennsylvania; Dr. Robison D. Harley, Atlantic City, New Jersey; Dr. Merrill B. Hayes, Chester, Pennsylvania; Dr. Horton C. Hinshaw, Rochester, Minnesota; Thomas H. Holmes, New York; Dr. James T. Mills, Dallas, Texas; Prof. W. J. B. Riddell, Scotland; Dr. Benjamin Rones, Washington, D.C.; Dr. L. von Sallmann, New York; Dr. C. L. Schepens, Brussels, Belgium;

Lieut. Col. Emory L. Shiflett, Cleveland; Dr. Frederick W. Stocker, Durham, North Carolina; Harold Westlake, Ph.D., Chicago; Helenor Campbell Wilder, Washington, D.C.; Dr. Stewart G. Wolf, Jr., New York; and Dr. Harold G. Wolff, New York.

The 1946 session, under the presidency of Dr. Gordon B. New, Rochester, Minnesota, had for its guest of honor, Dr. George M. Coates, Philadelphia. Dr. Curtis F. Burnam, Dr. Samuel J. Crowe, and Dr. Charles E. Iliff, Jr., all of Baltimore, presented a symposium on radiation therapy. Dr. Crowe's presentation was the Wherry Memorial Lecture.

The American Orthoptics Council had a

joint session with the American Association of Orthoptic Technicians.

PERSONALS

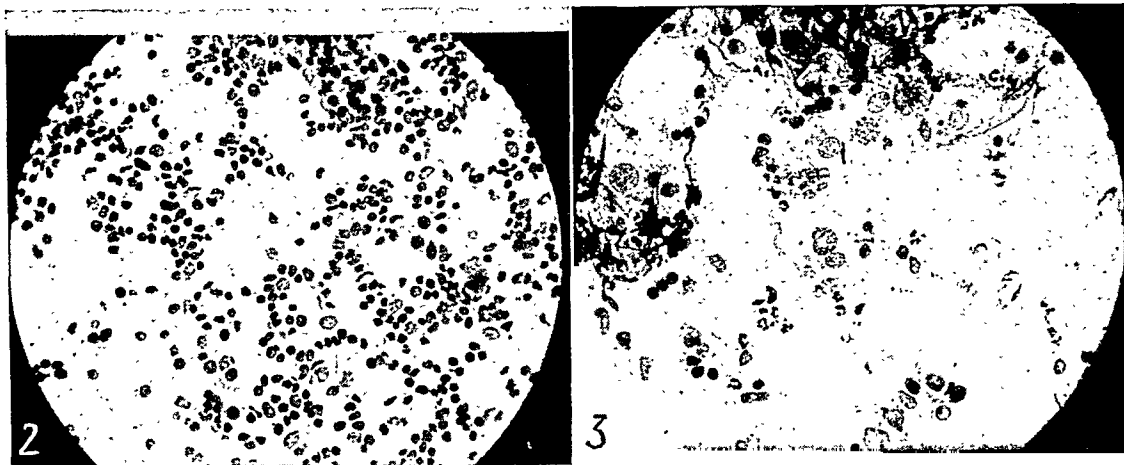
The following citation accompanied the award of the Legion of Merit to Dr. James N. Greear, Jr., 3532 Edmund Street, N.W., Washington, D.C. As a lieutenant colonel, Dr. Greear "rendered distinguished service as Chief of the Eye, Ear, Nose, and Throat Service, Valley Forge General Hospital, Phoenixville, Pennsylvania, from October, 1943, to February, 1945. Through his outstanding background, tact, and professional ability, Colonel Greear contributed greatly to facilitating the high standard of care rendered blind patients. . . ."

SIGNIFICANCE OF A MONONUCLEAR-CELL REACTION

Mononuclear cells, and the lymphocyte in particular, were consistently the predominant cells in exudates, smears, and scrapings from epidemic keratoconjunctivitis and acute follicular conjunctivitis, Béal; in the exudates, in fact, almost 100 percent of the cells (fig. 2) were mononuclear. Only in a few cases in which there was secondary infection with staphylococci were there any appreciable

reactions. This was consistent with the generally recognized fact that a lymphocytic reaction is the usual cell reaction to the typical viruses. In fact, the only pyogenic viruses known to involve the conjunctiva—namely, the viruses of trachoma (fig. 3), inclusion conjunctivitis, and lymphogranuloma venereum—cannot be classed as typical viruses and are soon to be placed in a separate category.⁸

In mononuclear-cell exudates, as well as in certain polymorphonuclear-cell exu-



Figs. 2 and 3 (Thygeson). Fig. 2, Mononuclear cell exudate in acute follicular conjunctivitis, Béal. Giemsa stain. ($\times 350$). Fig. 3, Polymorphonuclear leukocytes in exudate from acute trachoma. Giemsa stain. ($\times 350$).

numbers of polymorphonuclear cells. The preponderant cell was the small lymphocyte, but there were variable numbers of large mononuclear cells, most of them monocytes. Some difficulty was encountered in differentiating monocytes with round nuclei from large lymphocytes, but differentiation did not seem to be important. No reason could be advanced to indicate why the large mononuclear leukocytes were more prominent in one case than in another of the same disease.

It is of interest that the only case of acute herpetic conjunctivitis and three cases of conjunctivitis secondary to molluscum-contagiosum nodules of the lid margins showed pure mononuclear cell

exudates in which a significant proportion of the cells were monocytes, many shadow forms of the monocytes occurred. These shadow forms consisted of degenerated nuclei in which the mesh of the chromatin network had become widened to form many bizarre shapes and forms. While there was a certain variation in their number in the various conjunctivitides, no diagnostic significance could be ascribed to them.

SIGNIFICANCE OF A PLASMA-CELL REACTION

In spite of the well-known occurrence of plasma cells in the subepithelial infiltrate in many types of conjunctivitis,

plasma cells in the exudates and epithelial scrapings in this series were extraordinarily rare. In fact, with only a few exceptions, plasma cells were seen only in the scrapings and exudates from trachoma. According to Wilson,⁹ the plasma cell is the most important cell in the subepithelial infiltrate in trachoma, where it occurs in large numbers, and it is of interest that plasmomas not infrequently occur in chronic trachoma of high in-

appear in epithelial scrapings and exudate smears.

SIGNIFICANCE OF EPITHELIAL CHANGES

In vitamin-A deficiency of advanced degree, there is a tendency of the conjunctival and corneal epithelium to become keratinized. This is a characteristic of the conditions known variously as xerosis, xerophthalmia, and keratomalacia. In these conditions, the keratinization is grossly visible, and microscopic study unnecessary. Mild degrees of vitamin-A deficiency sometimes produce the condition known as prexerosis, in which the epithelial changes are mild and localized. Bitôt's spots, which are small, triangular areas of keratinization located selectively at the temporal limbus, are of some value in the diagnosis of vitamin-A deficiency and, in their early stages, can best be demonstrated microscopically. Epithelial scrapings from the temporal limbus area show keratinized epithelium, usually covered with xerosis bacilli (fig. 4). In Giemsa stains, the cells appear reddish, and the nuclei are absent or degenerated. The normal conjunctival epithelium of this area never shows keratinization or surface bacterial proliferation.

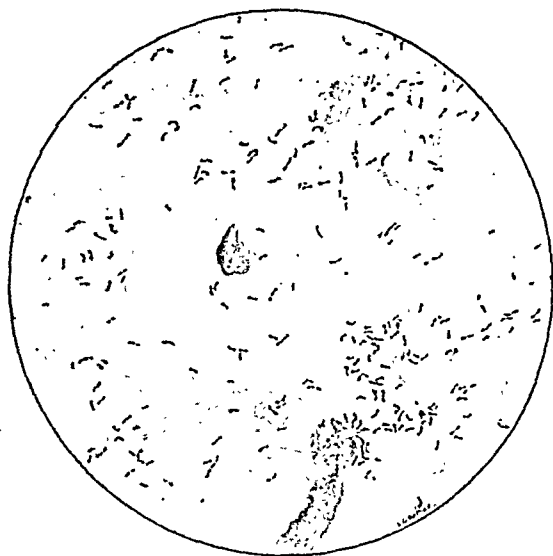


Fig. 4 (Thygeson). Epithelial scrapings from the bulbar conjunctiva of a patient with vitamin-A deficiency. Giemsa stain. Drawn from a magnification of 1,350.

tensity. The plasma cells in trachoma exudates in this series were never very numerous but were easily recognized and distinctive. It is believed that their presence has some diagnostic importance.

It is not certainly known whether the plasma cell has the ability to pass through the epithelial barrier of the conjunctiva or is seen merely as the result of the rupturing of trachoma follicles. As will be noted later, the gelatinous necrotic trachoma follicles rupture easily, even spontaneously, and it would therefore seem logical to expect plasma cells contained in the periphery of the follicles to

The value of this test has been questioned,¹⁰ but it is believed by the writer to have considerable value, although limited in this country by the relative infrequency of vitamin-A deficiency. In this series of 2,000 cases, for example, only eight instances of keratinization due to vitamin deficiency occurred. It is interesting that one of these was a pellagra due to chronic alcoholism. In the only three of the eight cases which could be followed for any length of time, vitamin-A therapy caused a disappearance of Bitôt's spots and a return of the conjunctival epithelium to normal.

Keratinization of the conjunctival

epithelium may occur, however, without relation to vitamin-A deficiency. It may occur as a result of exposure in old cases of ectropion or as a result of extreme cicatrization, as in old trachoma or ocular pemphigus. These conditions, however, present no diagnostic difficulty and are in no danger of being confused with suspected vitamin-A deficiency.

It should be remembered that the epithelium of the lid margin is normally keratinized and that occasionally keratinized cells from this source may appear in conjunctival smears. This is extremely rare, however, and caused no confusion in this series.

Keratinization without vitamin-A deficiency may also occur in the syndrome of keratoconjunctivitis sicca. In this disease, there is a deficiency of tears which is compensated for by the production of excessive amounts of mucus. While the conjunctival epithelium never becomes fully keratinized as in vitamin-A deficiency, the cells from an advanced case characteristically show keratin granules in the cytoplasm and degenerative changes in the nuclei. These changes (fig. 5) are so characteristic as to be of diagnostic significance. An extraordinary increase in the number of goblet cells in scrapings and an excessive amount of mucus complete a characteristic microscopic picture.

According to various authors, notably Feldmann¹¹ and Taborisky,¹² there are epithelial changes in trachoma other than the cytoplasmic inclusions which have diagnostic significance. Feldmann states that an early diagnosis of trachoma can be made from a study of scrapings from the tarsal conjunctiva. She states that in scrapings from the normal conjunctiva the epithelial cells come off in sheets, the nuclei are oval and of uniform size, and the staining of the nuclei is uniform and saturated. In trachoma, she

notes that the polymorphism of the epithelial cells is striking, that they tend to appear in scrapings as isolated cells rather than in sheets, and that their nuclei are round, variable in size, and larger than usual, staining irregularly and less intensely. She indicates that these observations were consistent in 356 cases of trachoma.

According to Taborisky, a cytodiagnosis of trachoma can be made as early as



Fig. 5 (Thygeson). Mucus and partially keratinized epithelial cells in conjunctival scrapings from keratoconjunctivitis sicca. Giemsa stain. Drawn from a magnification of 1,350.

the fifth day of the disease. The normal cylindrical cells of the conjunctiva become flattened, and the nuclei show characteristic changes consisting of thickening and poor staining of the chromatin network with irregularities in the nuclear membranes. He believes that these changes occur in no other type of conjunctivitis.

Observations on the 125 cases of trachoma in this series, however, failed to show epithelial changes which could be considered specific. It was true that the epithelial cells in trachoma tended to show polymorphism and irregular stain-

ing, but these same morphologic variations were also seen in cases of non-trachomatous conjunctivitis, particularly long-standing conjunctivitis. As will be stressed later, I consider the cytologic findings in expressed follicular material to be much more characteristic of trachoma than any epithelial changes.

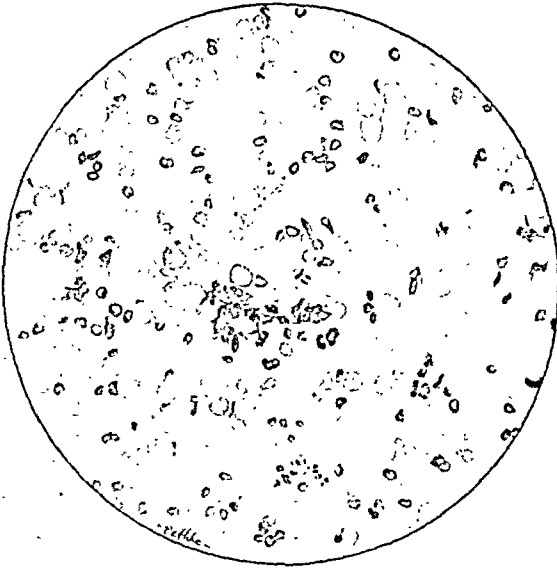


Fig. 6 (Thygeson). Follicular expression from trachoma, showing Leber cells, degenerated lymphoblasts, and cell debris. Giemsa stain. Drawn from a magnification of 1,350.

CYTOLOGY OF EXPRESSED FOLLICULAR MATERIAL

An extensive study was made of follicular expressions from trachoma and from nontrachomatous follicular conjunctivitis of various types. No difficulty was encountered in obtaining satisfactory preparations from trachoma, since the follicles were soft, gelatinous, and easily expressed. In contrast, all the nontrachomatous follicular conjunctivitis had hard, nonexpressible follicles from which material could be obtained only as a result of vigorous manipulation with ring forceps.

There was a very decided and diagnostic difference between the cytologic pic-

ture (fig. 6.) of the trachoma material and of the material from the other diseases. In trachoma, the predominant cell was the germinal-center cell, believed to be a lymphoblast. In lesser numbers were lymphocytes, plasma cells, occasional monocytes, and macrophages. The lymphoblasts had a very characteristic appearance. They showed many degenerative changes, varying in intensity from pallor of the nuclei to loss of cytoplasm. Scattered throughout the slide were many clumps of cell debris, mostly cytoplasmic. The appearance of the macrophages was also distinctive. They were the large macrophages (Leber cells), sometimes several times the size of epithelial cells, and contained in their cytoplasm masses of phagocytosed cell debris, largely nuclear in origin. In slides from typical active trachoma these large macrophages or Leber cells were quite numerous, as many as 25 occurring in a single slide. Ordinarily, however, their number varied between 5 and 20 per slide. Altogether a very characteristic cytologic picture was observed in every case of active trachoma.

A quite different cytologic picture was seen in nontrachomatous follicular material. Here the small mononuclear cells, mostly lymphocytes, were predominant, and there were none of the degenerative changes so characteristic of trachoma. The small number of lymphoblasts present showed normal staining and never any cytoplasmic fragmentation. There was almost complete absence of the cell debris so characteristic of trachoma. Macrophages were occasionally seen, however, but their number was never comparable to the number seen in trachoma, and there were no typical Leber cells.

The explanation for the differences in the cytologic pictures of the two types of

follicular disease probably lies in the necrotizing action of trachoma toxins. It is, of course, the cell necrosis in trachoma which results in the cicatrization so char-

minal-center cells in trachoma and for their paucity in the nontrachomatous diseases. This is probably due to the fact that the trachoma follicles are necrotic

TABLE 1
CYTOLOGY OF CONJUNCTIVAL EXUDATES

	Polymorphonuclear Cells	Mononuclear Cells	Eosinophils	Basophils	Free Eosinophilic and Basophilic Granules	Fibrin Exudate	Mucus Predominant	Follicular Expression			
								Macrophages	Lymphoblasts Predominant	Lymphocytes Predominant	Necrosis of Follicle Cells
Bacteria											
N. gonorrhoeae	+										
N. meningitidis	+										
N. catarrhalis						+					
Staph. aureus	+										
Strep. hemolyticus	+										
viridans	+										
nonhemolyt.	+										
H. conjunctivitis (Koch-Weeks)	+										
H. influenzae	+						+				
Diplobacillus (Morax-Axenfeld)						+					
Coliform bacilli	+										
Vincent's angina organisms	+										
Fungi											
Streptothrix foersteri	+										
Pityrosporum ovale	0										
Viruses											
Trachoma	+							+	+		+
Inclusion conj.	+										
Lymphogranuloma venereum	+									+	
Herpes simplex		+									
Epidemic keratoconj.		+									
Béal's conj.		+									
Molluscum contagiosum conj.		+									
Verruca vulgaris conj.		+									
Allergy											
Vernal catarrh			+	+	+						
Hay-fever conj.			+	+	+						
Atropine conj.			+	+							
Eserine conj.			0								
Phlyctenular conj.	+										

acteristic of the disease and which is completely absent from all the other follicular diseases. It is also interesting to speculate on the reason for the predominance of the large mononuclear, ger-

and express easily in such a way that only the germinal-center material is lost, whereas, in follicular conjunctivitis, the whole follicle has to be extirpated in order to get a satisfactory smear. In a

whole follicle, the small mononuclear cells are, of course, more numerous than the germinal-center cells.

DISCUSSION

As was expected, the polymorphonuclear-cell reaction was the most common cytologic feature of exudates from conjunctivitis. In most infections, the demonstration of this reaction pointed to a pyogenic bacterium as the etiologic agent, but there were some notable exceptions. For example, the three atypical viruses of ocular importance, all members of the psittacosis - lymphogranuloma - venereum group of viruses, were all pyogenic. The typical viruses, on the other hand, as exemplified by herpes-simplex virus, induced an almost purely mononuclear-cell reaction. On this basis, the demonstration of polymorphonuclear cells in the exudates of the conjunctivitis from erythema multiforme and psoriasis arthropathica, diseases of unknown etiology, suggests that typical viruses, at least, are not concerned in their etiologies.

The only fungus concerned in conjunctivitis in this series—namely, *Streptothrix foersteri*,¹³ the causative organism of streptothrix concretions of the canaliculus—was also definitely pyogenic, inducing a marked polymorphonuclear-cell reaction in the exudates from the secondary conjunctivitis. On the other hand, the mild conjunctivitis secondary to pure seborrheic blepharitis,¹⁴ and believed to be caused by *Pityrosporum ovale*, was extraordinarily low in leukocytes. Over half the cases of phlyctenular conjunctivitis in the series were characterized by a polymorphonuclear exudate, but it is noteworthy that there was an almost absolute correlation between this cell reaction and the occurrence of secondary staphylococcic infection. In the few uncomplicated cases, it was difficult to demonstrate any leukocytes whatever in the scanty exudate, if indeed there was any

exudate at all. When leukocytes were present, they were almost equally divided between polymorphonuclear and mononuclear cells.

As can be seen, therefore, the diagnostic significance of a polymorphonuclear-cell exudate was limited, but there were certain cases in which its demonstration was of decided value. For example, differentiation between the acute follicular conjunctivitis due to inclusion-conjunctivitis virus and Béal's conjunctivitis¹⁵ of still unknown etiology, which at onset are often indistinguishable, could readily be made from an examination of the exudate, since inclusion conjunctivitis has a polymorphonuclear-cell reaction and Béal's conjunctivitis a mononuclear-cell reaction.

The demonstration of a mononuclear-cell reaction was found to have considerably more diagnostic value. As was expected, the typical viruses such as herpes-simplex virus, the virus of epidemic keratoconjunctivitis, and the virus of molluscum contagiosum, induced a lymphocytic reaction which was of considerable value in diagnosis when correlated with clinical and bacteriologic findings. The demonstration of a pure mononuclear-cell reaction in Béal's conjunctivitis suggests strongly that the agent of this infection will eventually be shown to be one of the typical viruses. It must be remembered, however, that there is at least one bacterium—namely, *L. monocytogenes*—which has the ability to induce a mononuclear-cell reaction. To the best of my knowledge this organism has never been found in human conjunctivitis, however, although an experimental ocular infection in rabbits has been studied by Julianelle.¹⁶

As was expected, the eosinophil was the cell having the greatest diagnostic value. It is well known that the eosinophil in small numbers may be present in tissue infiltrations without an allergic

basis, but, except for its occurrence in ocular pemphigus, a conjunctival eosinophilia proved to be an almost certain indicator of conjunctival allergy. Conjunctival eosinophilia has been reported in ultraviolet light conjunctivitis¹⁷ and in self-induced conjunctivitis due to ipecac,¹⁸ but the few cases of arc burns in this series showed no leukocytic reaction whatever. There were no cases of self-induced conjunctivitis, and drug conjunctivitis was accompanied by an eosinophilia only when an actual sensitivity had developed. For example, eosinophils were never demonstrable in the silver-nitrate conjunctivitis produced in newborn babies by the Cr  d   procedure. The fact that ocular pemphigus always showed a mild conjunctival eosinophilia was of some interest but in no way confusing, since the clinical picture of ocular pemphigus was always distinctive enough to eliminate the possibility of typical allergy. Of more significance was the fact that old cicatricial trachoma never showed conjunctival eosinophilia, whereas old cicatricial ocular pemphigus always did. Although differentiation between these two diseases can usually be made on clinical findings alone, a few cases occurred in this series in which the cytologic findings had distinct diagnostic value.

That a conjunctival basophilia usually paralleled a conjunctival eosinophilia was an unexpected finding and one which is believed to have definite diagnostic possibilities. Although isolated basophils were found in many other types of conjunctivitis, they were not found in any considerable numbers except in typical conjunctival allergy. The basophil is a cell more easily recognized than is the eosinophil, particularly by persons with any degree of color-blindness, and can always be recognized with the low-power objective of the microscope.

In this series, no satisfactory study of the granulomatous conjunctivitis was

possible. Two cases of tuberculosis with hypertrophic nodules showed no exudates at all; whereas, one with a single conjunctival ulcer showed polymorphonuclear cells as the most common cells in scrapings from the base of the ulcer. As is well known, this leukocyte is seen in tuberculous lesions only when necrosis has taken place. There were six cases of conjunctivitis due to the *Leptothrix* (Verhoeff¹⁹), but in only two of these was there sufficient exudate for cytologic examination. In these two cases, polymorphonuclear and mononuclear cells occurred in about equal numbers. There were no cases of tularemia or syphilis.

Cytologic studies of expressed follicular contents from trachoma and from various other etiologic types of follicular conjunctivitis offered considerable diagnostic interest. The phenomenon of necrosis so characteristic of the trachoma follicle was completely absent in the follicles of the other conditions. No diagnostic differences among these other non-trachomatous follicles could be made out, but the differences between them and the trachoma follicle were striking. The significance of this observation is somewhat limited by the fact that the contents of the follicle must be mechanically expressed, but it was found to have definite value in certain atypical cases in which clinical differentiation was not possible. It is believed also that these cytologic changes may be useful in differentiating trachoma follicles from nontrachoma follicles in the same individual in whom trachoma may have supervened on a conjunctiva already showing follicular hypertrophy.

In my opinion, cytologic studies should be a routine part of the examination of conjunctival disease and should be reported simultaneously with the bacteriologic findings.

SUMMARY AND CONCLUSIONS

1. In a microscopic study of exudate

smears and conjunctival scrapings from 2,000 cases of conjunctivitis of diverse etiology, variations in leukocytic reactions and epithelial changes were found to be sufficiently marked to have diagnostic value.

2. Polymorphonuclear-cell exudates were characteristic of bacterial infections in general, but there were a few exceptions. Diplobacillary conjunctivitis was characterized by a fibrinous exudate without leukocytes unless there was secondary infection with staphylococci. Chronic N. catarrhalis conjunctivitis also showed minimal or no leukocytic reaction.

3. Conjunctivitis produced by the typical viruses always showed a characteristic mononuclear-cell exudate with few, if any, polymorphonuclear cells. In contrast, the three viruses of the psittacosis-lymphogranuloma - venereum group of viruses—namely, trachoma, inclusion conjunctivitis, and lymphogranuloma venereum viruses—always showed a polymorphonuclear-cell exudate.

4. Epithelial changes consisting of various degrees of keratinization were of value in the diagnosis of early vitamin-A deficiency. Mild keratinization of the epithelium combined with an increase in goblet cells and mucus was characteristic of keratoconjunctivitis sicca.

5. A predominance of eosinophils in

the exudate was characteristic of vernal catarrh and of typical conjunctival allergies such as hay-fever conjunctivitis. Bacterial allergy; as exemplified by phlyctenular conjunctivitis, showed no eosinophils in the exudate. A conjunctival basophilia was also found in the typical allergies but was neither so constant nor so specific as the eosinophilia. The occurrence of free eosinophilic and basophilic granules released from disintegrating cells was found to have some diagnostic value.

6. The cytology of expressed-follicle contents showed striking differences between the cells of trachoma and those of other follicular conjunctivitis. These differences appeared to be related to the fact that cell necrosis is a striking feature of trachoma but not of the other diseases.

7. The cytologic changes found in this study were in only a few exceptional instances pathognomonic of the etiologic type of conjunctivitis concerned, but when correlated with clinical and bacteriologic findings they were often of distinct diagnostic importance.

8. It is recommended that a statement on cytology be a part of every laboratory report on conjunctival scrapings or exudates.

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DISCUSSION

DR. PARKER HEATH (Detroit, Michigan): Dr. James H. Allen asks: "Can a distinction be made between acute conjunctivitis, type Béal, and epidemic keratoconjunctivitis by cytologic study?"

DR. PHILLIPS THYGESON (San Jose, California): At the present moment, I don't think any distinction can be made between the cytologic findings in these two diseases. We at one time thought that there were specific inclusion bodies associated with epidemic conjunctivitis; that is, bluish, amorphous bodies in the cytoplasm of conjunctival and corneal epithelial cells which had some diagnostic significance, but we have since found these same bodies in other diseases, and we think they are probably nonspecific.

DR. HEATH: The second question Dr. Allen wishes to ask is: "Do you consider macrophages (Leber's cells) pathognomonic of trachoma?"

DR. THYGESON: The Leber's cell is nothing but a large macrophage. They were in trachoma, certainly more numerous than in any other types of conjunctivitis studied, but they were also found in other infections. It seems to me that the presence of numerous Leber's cells in association with signs of cell necrosis and a predominance of lymphoblasts does indeed make a pathognomonic picture. I believe macrophages in other types of conjunctivitis tend to be definitely smaller than the Leber cell which is an extraordinarily large macrophage.

I am sure that the cells stem from the

same origin, but there is an extraordinary size difference between macrophages from trachoma and those from other types of conjunctivitis.

DR. HEATH: Dr. Allen's third question is: "Will you discuss the importance of proper selection of the site for removal of material for cytologic study?"

DR. THYGESON: It is a good rule to take cytologic material from the point of maximum disease intensity. Where exudate smears are taken, this is not of much significance, since most exudate accumulates in the inner canthus. Scrapings, however, are best taken from the site of maximum disease intensity.

When one is looking for suspected vitamin-A deficiency, it is important to recognize that the temporal limbus is the site most commonly affected in early deficiency. We would then take our scrapings from the outer temporal limbus area. This is the site where a Bitôt's spot is most commonly seen.

DR. HEATH: Dr. Donald J. Lyle asks the fourth question: "What are the best stains to use routinely in the laboratory investigation?"

DR. THYGESON: I have used about a half-dozen different cytologic stains, and I definitely prefer the Giemsa stain. We fix our material in absolute methyl alcohol and then stain in dilute Giemsa solution (1 drop to 2 c.c. of neutral distilled water) for about an hour. We then pass the slide through two changes of 95-percent alcohol to remove the stain débris. This makes a

very satisfactory cytologic stain. Then, there is the Wright's stain, which is satisfactory and more rapid. I am sure there are two or three other stains which would work equally well, but I, personally, prefer the Giemsa.

DR. HEATH: Dr. V. C. Rombo asks: "Please discuss the differentiation between inclusion blennorrhea and trachoma."

DR. THYGESON: I think it is perfectly possible to make a cytologic differentiation between these two diseases, especially in the adult. Both diseases have identical inclusion bodies; both diseases are characterized by a polymorphonuclear-cell exudate. It is the follicle cytology which makes the differentiation possible. In inclusion conjunctivitis in the adult, the follicles show none of the degenerative changes characteristic of trachoma, and one gets the cytologic picture of the nontrachomatous follicle in contrast to the numerous cytologic changes so characteristic of trachoma.

I recognize that clinical differentiation is possible in most cases, but there are certainly occasional confusing cases in which cytologic study may be of value.

DR. HEATH: This question is from Dr. K. W. Ascher: "Did you observe, in cases of vitamin-A deficiency, syncytiumlike membranes of keratomized epithelial cells?"

DR. THYGESON: I may have seen those but I did not recognize them as particularly characteristic. I am sorry; I really can't answer that question.

DR. EDWARD C. ELLETT (Memphis Tennessee): In speaking of the reaction to atropine, Dr. Thygeson made the distinction that the reaction to atropine was an allergic reaction and that to eserine was a toxic reaction. I should like to ask if he made any sensitivity tests for these two drugs in these conditions.

DR. THYGESON (closing): First of all, I noted that there was a very marked clinical difference between the conjunctivitis produced by these two drugs. The atropine reaction was typically a contact conjunctivitis and dermatitis, with widespread dermatitis of the eyelids; whereas, I never saw skin reactions in eserine catarrh. I recognize that these may well occur, but I have not seen them, personally. Secondly, I noted that the conjunctival reaction in atropine conjunctivitis was a papillary hypertrophy; whereas, in eserine conjunctivitis it was a follicular hypertrophy.

I made a number of tests, both by patch and by intradermal methods, and I was consistently able to obtain a positive patch test to atropine. Some were low grade, and others rather violent. However, I never succeeded in obtaining a patch test to eserine. I did not make serologic studies.

CONTRIBUTIONS TO THE SURGERY OF CONGENITAL CATARACT*

I. MODIFICATION OF DISCISSION IN THE PRESCHOOL AGE GROUP

WILLIAM F. MONCREIFF, M.D.

Chicago

The present essay will attempt an analysis and evaluation of some important problems encountered in the surgery of the congenitally cataractous lens in the young child. It will present certain modifications of technique, devised and developed by me within the past two years, which are applicable to the preschool child, between the ages of one and six years, together with a report of three cases in which this method was employed.

Certain criteria may be stated to which any operation for congenital cataract in this early period of life, if it is to be adequately safe and efficient, should conform:

1. A single operative procedure should provide for rapid and complete absorption of the lens cortex and nucleus within four to eight weeks, without any but the most remote danger of severe reaction or increased tension. Thus, the need for a second operative procedure, or discission of a thin membrane, would be at least as infrequent as following extracapsular extraction of adult cataract, and correcting lenses could be prescribed within one to two months after operation, as in the case of the adult patient.

2. The incision in the limbus should be minimal, scarcely more than a puncture, so as to avoid prolapse or incarceration of the iris or other structures.

3. The operation should be limited to the lens, and should not involve the iris,

the vitreous, or even the posterior capsule of the lens.

The author's procedure, omitting ordinary routine details of preoperative preparation and anesthesia, is briefly as follows. First of all, the most complete mydriasis (fig. 1) possible to attain by any or all means must be secured. There

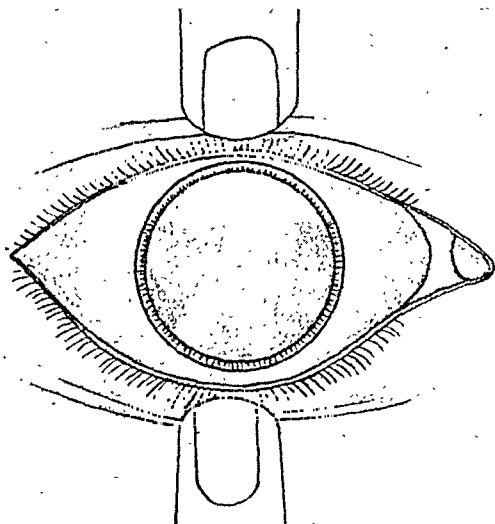


Fig. 1 (Moncreiff). Preoperative dilatation of the pupil.

are several reasons for this. They are:

The wider the pupil, the greater will be the expanse of the pupillary portion of the anterior chamber; thus, the more readily can lens substance enter the anterior chamber and remain there. Most important is the greater access thereby gained to the outlying portions of the anterior part of the lens approaching the equatorial region. Finally, there is the fact that the wider the pupil at the time of operation, the less the difficulty of maintaining a wide pupil after operation.

The knife-needle enters through the limbus at the temporal end of the hori-

*From the Departments of Ophthalmology of Cook County Hospital and of the College of Medicine, University of Illinois. Read before the Chicago Ophthalmological Society, March 18, 1946.

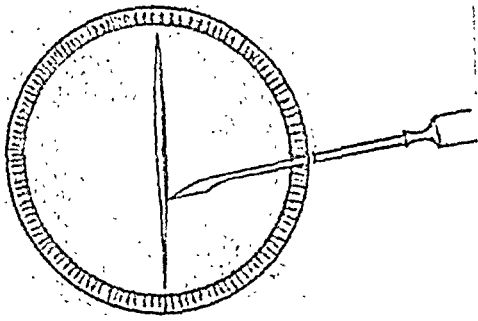


Fig. 2 (Moncreiff). Primary incision into the lens.

zontal meridian of the cornea, makes a vertical incision through the anterior capsule and into the cortex (fig. 2), and then multiple incisions in all directions through the lens capsule and anterior cortex (fig. 3), down to the nucleus, across the full expanse of the widely dilated pupil, until the anterior capsule and anterior cortex are literally reduced to shreds and small particles (fig. 4). When the nucleus appears and separates from the cortex, it is cut into several fragments (figs. 4 and 5), and a few light strokes are made into the posterior cortex, taking care not to puncture the posterior capsule, or to lose aqueous. With a properly made instrument, such as my model of the

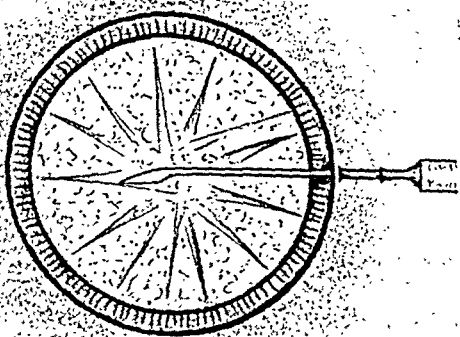


Fig. 3 (Moncreiff). Consecutive incisions into the lens.

Ziegler knife-needle, the operation can be carried to this point with little or no aqueous loss. The knife-needle is then withdrawn, permitting the escape of some aqueous. The tip (23 gauge) of the anterior-chamber irrigator (fig. 6) is then introduced through the knife-needle puncture, and fluid injected in the direction of the posterior capsule and toward the center of the pupil (fig. 5). This has the effect of removing cortical material from the remnants of the capsular sac and displacing it into the anterior chamber.

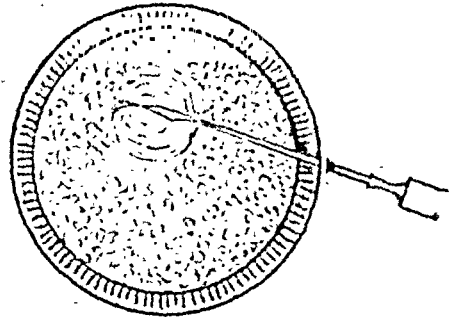


Fig. 4 (Moncreiff). Division of the lens nucleus.

Should it happen through accident or faulty technique that too much aqueous escapes before the multiple incisions of the lens are completed, the irrigator should be used to restore the anterior chamber, and another knife-needle of slightly larger size introduced through the same puncture to complete the division of the lens structure.

The essential feature of postoperative care is to maintain the wide dilatation of the pupil, which is much more readily done after this type of operation than after the conventional discission. It need scarcely be said that in addition to atropine ointments of whatever dosage can be borne by the individual patient, great reliance is placed, both pre- and postoperatively, on epinephrine-type drugs which

are powerful stimulants of the dilator pupillae, particularly neosynephrin in a 10-percent solution or emulsion.

From May 1, 1944, to May 9, 1945, the operative procedure just described was employed in six eyes of three patients, as follows.

CASE REPORTS

Case 1. J. V., a colored girl, aged 14 months, was first examined on April 20, 1944. Her history told of white pupils being noted at birth. The child had always been poorly developed physically. A physical survey revealed general under-

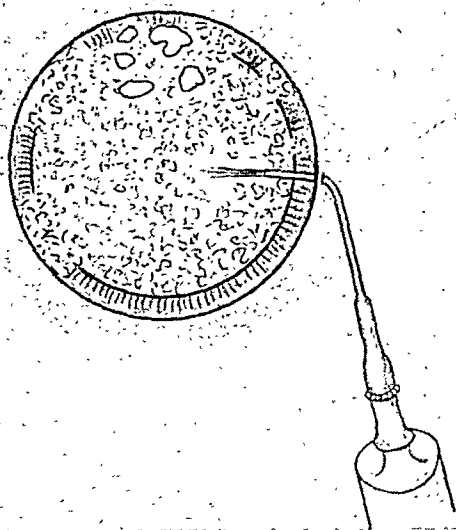


Fig. 5 (Moncreiff). Introduction of irrigator tip and displacement of lens fragments into anterior chamber.

nourishment and underdevelopment, with congenital heart disease. Body weight was only 18 lbs. The eyes exhibited asymmetrical pendulum nystagmoid movements. Pupillary reaction to light was normal; the irides were dark brown; the dull-white lenses were completely opaque; there was no fundus reflex even through the periphery, with widely dilated pupils.

Operative procedure on both eyes, under general anesthesia, was undertaken on April 26, 1944. In this case, a small, narrow Graefe knife was used for the

primary puncture at the limbus, and the incision of the anterior capsule and cortex of the lens. The knife-needle was then substituted for the remainder of the lens incisions. The irrigator tip was then introduced, and the fragments of lens sub-



Fig. 6 (Moncreiff). Goldstein anterior-chamber irrigator.

stance displaced into the anterior chamber by injecting physiologic saline solution.

The postoperative course was characterized by a minimum of inflammatory reaction; there was only the faintest bulbar injection. During the first week, the anterior chamber of each eye was entirely filled with fragments of lens substance. Wide dilatation of the pupils was maintained without much difficulty. At the end of four weeks, after gradual absorption, the fundus reflex was clear throughout the pupil of each eye, and only a thin transparent membrane spanned the pupillary space, fringed along the pupillary margins with minute remnants of lens substance.

On June 26, 1944, skiascopy at 0.5 meter showed: R.E., +12.00; L.E., +11.00. No adequate record of visual acuity could be made. The lenses prescribed (according to the skiascopic findings) were: R.E., +10.00; L.E., +9.00

Case 2. B. J. A., colored girl, aged 2½ years, when first examined on November 25, 1944, had a history of being a premature infant with a birth weight of 4 lbs., 11 oz. White pupils were noted at birth. A physical survey revealed nothing especially noteworthy in the general condition. The eyes displayed slow pendulum

nystagmoid movements. Pupillary reaction to light was normal; the irides were dark brown; each lens was completely opaque, as in case 1.

Operative procedure on both eyes, under general anesthesia, was undertaken on November 29, 1944. The details of the operative procedure were substantially the same as in case 1, except that no Graefe knife was used, the knife-needle being used entirely for the discission part of the procedure.

The postoperative course was similar to that in case 1, except that at the end of two weeks the right pupil was entirely clear of lens substance, and the left pupil was almost clear.

This patient was discharged from the hospital two weeks after operation. Since then, coöperation as to return visits has been so poor that no data on the refraction and visual acuity have, as yet, been obtained.

Case 3. R. H., a colored boy, aged five years, was first examined on May 2, 1945. His history included cataractous changes noted in the crystalline lens of each eye at birth by the attending physician. A physical survey revealed his general condition to be normal. The visual acuity of each eye was limited to counting fingers at 3 feet. There was no nystagmus nor nystagmoid movement. In each lens, there was fairly dense central lamellar (or zonular) opacity, apparently about 6 mm. in diameter and of a stellate pattern, lying in the periphery of the fetal nucleus and surrounding layers. There were many fine, white dots of opacity throughout the periphery of each lens. The irides were dark brown. No lesions were found in the portions of the fundi which could be seen through the periphery of the lenses with widely dilated pupils.

Operative procedure on both eyes, under general anesthesia, was undertaken on May 9, 1945; using the same technique

as in case 2. In the right eye, the nucleus was not divided but in the left eye, the nucleus was cut into three fragments.

The postoperative course was characterized, as in the other two cases, by a very slight degree of bulbar injection. The nuclear portion of each lens completely disappeared within a month, by June 4, 1945. The pupillary zone of the right eye was entirely clear of lens material, and the corrected vision of the right eye at this time was 0.8, but not until July 2, 1945, almost two months after operation, was the pupil of the left eye clear.

On June 16, 1945, the refraction of the right eye was: +12D. sph. \ominus +2.50D. cyl. ax. 105° = 0.8 (illit.); and that of the left eye was: +11.75D. sph. \ominus +2.50D. cyl. ax. 90° = 0.8 (illit.). On October 8, 1945, corrected vision was: R.E., 0.8+2 (illit.); L.E., 0.8+3 (illit.).

In addition to these three patients, there were three other patients, operated on during the past two years, who do not fit into this category, as the irrigator technique was not used or needed. The reasons for this were: In one patient the lenses were hypermature; consisting only of capsule containing milky fluid; and, each of the other two patients was under one year of age, at which age the lens structure is so delicate that the entire procedure can easily be accomplished with the knife-needle alone, and without the use of the anterior-chamber irrigator.

REPORTS IN THE LITERATURE

A complete review of the literature is not contemplated in this paper, and reference will be made to only a few publications related to points upon which it is desired to place special emphasis.

Prevention would, of course, be the ideal method of solving the problem of congenital cataract. In so far as the developmental forms are concerned, there are numerous articles in the literature de-

voted to the role of heredity, some complete with extensive and complicated family trees, all of which are of great scientific and academic interest. It may be that in the dim and distant future, by virtue of such studies, the elimination of all hereditary and developmental cataracts will be achieved.

Be that as it may, it would seem that the *surgery* of congenital cataract has been, for the past 25 years, a greatly neglected subject, as indicated by the fact that since Ziegler's¹ publication, in 1921, of his V-shaped or through and through discission of the lens, nothing actually new in principle has been published on this subject, so far as I have been able to discover.

During this 25-year period, although only a relatively few papers dealing with surgical procedures for congenital cataract have appeared, and these devoid of any real solution of the unsolved difficulties, there has been an avalanche of publications concerning adult or so-called senile cataract, most of which lay particular emphasis on surgical procedures. During this period, the modern techniques of intracapsular extraction have been evolved and popularized, and important improvements (in the extracapsular operation), as well as various safety measures for lens extraction in the adult patient, have been devised and rather generally adopted. This discrepancy between the attention accorded the surgery of congenital as compared to that given adult cataracts would not be particularly remarkable were it not for the fact that, previous to these developments of the past 25 years, the results of extracapsular lens extraction in the adult patient, in skilled hands, were already better than the results of any procedure or combination of procedures for congenital cataract. The one possible exception to this assertion is the Ziegler operation to which there are important basic objections, as will be

shown later. Various reports of surgical and visual results in congenital cataract have been made. Usually these reports have been characterized by too high a percentage of surgical complications and failures, entirely aside from the well-known incidence of amblyopia, nystagmus, and various congenital eye defects other than cataract which, of course, ought to be sharply distinguished from the surgical failures.

The most recent contribution of this kind is that of Falls,² whose report of the results in 131 cases at the University of Michigan between 1925 and 1942 will serve as an example. In this series, the number of eyes operated on was 223, and the number of operations 510, plus 14 others which complications necessitated. There were 413 discissions and 64 linear extractions, 60 of which followed discission and were done for the removal of swelling cortical material. In 19 of these eyes, there was increased tension or secondary glaucoma which, in 9 cases, persisted after linear extraction. Falls does not mention in his paper whether or not the Ziegler type of discission was used in any of these cases. However, in a personal communication Dr. Falls said that the Ziegler operation was not done.

Among other supplementary operations employed to relieve complications were: extraction of secondary lens membrane (5), iridocapsulotomy (4), iridectomy for prolapsed iris (4), excision of anterior synechia (2), cyclodialysis (4), Elliot trephine and LaGrange sclerectomy (1 each), and one enucleation. The greatest number of discissions performed on any one eye was six, but the number of eyes on which more than two, or more than three, discissions were performed is not stated. These surgical facts would appear to be more significant in evaluating the efficiency of the surgical methods used than are the visual results reported, since, unfortunately, no selective informa-

tion is given as to which visual defects were chargeable to surgical complications and failures, and which to amblyopia and to congenital defects other than cataract. Postoperatively, 53.5 percent of the 233 eyes attained corrected vision of 6/30 or better; whereas, 16.8 percent were industrially blind, and in 20.6 percent the visual acuity was indeterminate. An attempt is made to draw conclusions as to the relative efficiency of discission alone and discission followed by linear extraction, by citing that only 27.1 percent of the group treated by discission achieved vision of 6/12 or better, compared with 54.9 percent of the group in which discission was followed by linear extraction. However, in comparing acuity for near vision, the advantage, although slight, was with the group treated by discission only, to the extent that 27.7 percent (as compared to 25.4 percent) could read Jaeger 1 to 3.

The final conclusion offered is that "Surgical intervention in early life is hazardous, as shown by the fact that a high percentage of complications and 33 percent of the total failures occurred in the age group under two years." It should be noted, however, that this group was a small minority of the whole series, only 17.5 percent, or 23 patients. The present author doubts the validity of the above conclusion, and considers that, at best, it can apply only to the methods used and to the operators who used them. If any considerable number of the operations on patients under two years of age were done by beginners, then there is the possible factor of a higher proportion of complications in this age group due to insufficiently skilled operators.

In Falls' series, discission of the "lens capsule" was stated to be the safest technique for children under two years of age. This notion about limiting the operation to the capsule (without including the cortex and nucleus) will be

commented upon later. Falls also makes the suggestion that, when the cataractous condition is complete and bilateral, six months of age should be chosen as the time for operation on the first eye, and two years of age for that on the second eye. This suggestion is faulty on both counts.

First, very few, if any, infants will be found, especially those with brown irides, in whom sufficient pupillary dilatation can be obtained at six months to make the operation expedient at so early an age. There are a few at eight months of age, and the proportion increases rapidly until, at one year and older, there are few which present any serious difficulty.

Secondly, if a correcting lens is applied and good vision develops in the first eye, the second eye will have more than a year in which to become amblyopic. A year should be ample time in many cases for the amblyopia to become so fixed as to constitute a troublesome problem in itself. In brief, if both eyes require operation, both should be done at once, barring some definite contraindication.

Let us now examine the prospects of success for the conventional surgical procedures for congenital cataract in terms of the criteria stated in the introductory paragraphs of this article. Under the first heading—a single operative procedure should provide for the rapid and complete absorption of the lens cortex and nucleus, within four to eight weeks—what is the record of ordinary discission? Falls' reference to discission of the "lens capsule" as the safest procedure in the child under two years of age expresses the false conservatism and timidity of many operators of the past, and doubtless some of the present day. If the incision is made with the intention of limiting it to the anterior capsule of the lens, the absorption of the lens substance, in the average case, will be very slow, and one such operation will rarely reduce the lens to a

membrane thin enough to be dealt with definitively and finally by a single subsequent operation. After such an inadequate primary operation, there is usually great difficulty in maintaining a widely dilated pupil, so that the iris itself becomes an obstacle preventing access of aqueous to the lens substance. The consequence is inadequate absorption of the lens substance and, after one or more such procedures, a tough fibrotic mass may result so that no amount of subsequent discission can succeed in obtaining a clear pupil. Uveitis, increased tension, and secondary glaucoma should rarely occur under six years of age with any type of discission, since up to this age the lens is very soft and its nucleus small and not hard. Such young eyes usually react favorably. There are, nevertheless, certain factors which tend to produce these complications and which, at older ages, become very formidable. Faulty technique, in the sense that there is pulling or traction on the zonule and ciliary processes instead of clean cutting into the lens, can cause a marked rise in tension, even within a few hours, and this is usually accompanied or followed by iridocyclitis. There is, of course, no excuse for this faulty technique in any type of discission. The swelling of large masses of lens substance, if located behind the iris and toward the chamber angle, is likely to produce anterior uveitis and increased tension, especially in older children and adolescents.

The author's method attempts to avoid these complications and to insure rapid absorption of lens substance by dividing the lens cortex and nucleus into as many and as small fragments as possible and then by displacing these fragments into the anterior chamber. The lens particles are too large to affect the osmotic equilibrium, so they cannot elevate the tension by that mechanism; and they are too small to cause a rise of tension by mechanical

swelling, particularly since they are away from the chamber angle and in front of the iris. What of the masses of flocculent lens cortex that cannot be divided into small fragments? There is no question that soft lenses vary in their physical properties, and this condition may be encountered in some cases. However, these masses can easily be displaced into the anterior chamber by the use of the irrigator; the only difficulty which they cause is slower absorption.

The criterion set forth under the second heading of the introduction of this article—that the limbal incision should be limited to the puncture of a knife needle—rules out all forms of so-called linear extraction, in which there is an ever present danger of iris prolapse, even in the Barkan³ method of using a keratome incision in the clear cornea. In the case of children under six years of age, and perhaps in some a bit older, there should as a rule be no occasion which requires the extraction of lens substance after discission by the method presented in this paper. However, for discission alone, of whatever type, there is an upper age limit, whether it be 10 or 20 years, and beyond this age limit some method of extracting most of the lens substance will be necessary. The author has in mind a type of procedure for these older patients, with positive safeguards against iris prolapse, which, when sufficiently tried out, will become the basis of a subsequent communication.

The third criterion, stated in the introductory paragraphs, bears on the question of optical iridectomy on the one hand, and the Ziegler operation on the other. Optical iridectomy, such as might be employed for the varieties of congenital cataract with centrally located opacities, requires little comment, since it has been virtually abandoned for two obvious reasons: (1) the optical imperfection of the peripheral and even the paracentral

portions of the lens and cornea; and (2) the importance of the optical and cosmetic functions of the intact pupil, especially in young individuals. On both counts, aphakia with a round pupil is preferable.

In discussing the Ziegler operation, one enters upon what may prove to be the most controversial phase of this entire subject. It is conceded at once that undoubtedly many good, immediate results have been obtained by this method, with a single operation and in record time. (The same can be said, however, for the obsolete couching operation.)

The fundamental question is: What is the future of eyes operated on by the Ziegler method, especially in the later years of the patient's life, when the operating surgeon has long since passed from the scene? Can we really traumatize the vitreous with impunity, especially in the eye of the infant or young child?

This is an important question, and especially so in view of the incomplete state of our knowledge of the pathogenesis of retinal detachment, glaucoma, and various other intraocular disorders. While I have witnessed no late complications in such cases, for the simple reason that I have had no occasion to observe any adult or other patient in whom the Ziegler operation had been done, I take this opportunity to invite ophthalmic surgeons to report any data they may have which bears on this point.

For those who like to attempt to settle vexatious questions by citing authorities, reference will now be made to some comments on the Ziegler operation by several well-known ophthalmologists. The following statements were made at meetings of the Academy. One occasion was in 1926 during discussion of a paper by Dean;⁴ another was in 1928 when a paper by Wilder⁵ was being discussed. The Ziegler operation was disapproved by Dean, Greenwood, Lancaster, and Wilder, all of

whom stated that they were opposed to any traumatizing of the vitreous. Dean, in particular, questioned the validity of Ziegler's claim that his operation is never followed by increased tension. Benedict and Wiener, on the other hand, endorsed the Ziegler operation and saw no harm in the trauma to the vitreous incident to it. Benedict remarked that he could not see what difference it made whether the vitreous was incised at the first operation or the last.

Some of these discussants gave no particularly cogent reason why they approved or disapproved the Ziegler operation and its attendant trauma to the vitreous. Lancaster, however, in referring to one of his patients in whom an acute rise of tension followed the Ziegler operation and made it necessary to evacuate the lens material, remarked that the vitreous escaped more easily than the lens substance. Since that experience, he has not used the Ziegler procedure. Wilder believed that a marked delay in the absorption of the lens occurred when vitreous was allowed to mix with lens substance, as in the Ziegler operation. Ziegler himself, in his original report in 1921, stated that, while it was undesirable to "stir up" the vitreous, there would be no harm in making a clean cut incision into it with a sharp knife.

Nevertheless, it is an established fact that the vitreous breaks down as a result of direct trauma, to which it is very sensitive. Duke-Elder⁶ states: "The vitreous is a homogeneous gel in a very unstable state of dynamic equilibrium, the consistency of which can be readily destroyed by the slightest mechanical insult." E. Redslob⁷, who is internationally known for his work on the vitreous, in discussing the pathologic changes in the vitreous which arise solely from disturbance of the vitreous gel, states that a mechanical lesion, or trauma, is sufficient to cause a separation between the framework and

the liquid phase. In discussing disorganization of the vitreous by upset of the colloid equilibrium, he further states, under the heading of injuries of the eyeball: "Contusion may disorganize the vitreous structure. The same effect is produced by perforating wounds. In such cases, the bundles of agglutinated fibres converge toward the wound. This disorganization is readily observed when, following an accident or an operation, the vitreous body is extruded into the anterior chamber." As the eye pathologist can testify, the safest place for the vitreous is its normal habitat, and it does not stay there if one sticks a knife into it by way of the anterior chamber. No attempt will be made here to catalogue or describe the pathologic processes, some leading to secondary glaucoma, which may result from the prolapse of vitreous into the anterior chamber, a result virtually inherent in the Ziegler operation. It is sufficient to say that, in so far as cell growth plays a part in these processes, it is much more active in the young child than in the mature adult.

The idea that the vitreous must necessarily be incised in the discission of a thin membrane remaining after discission of the lens, as implied by Benedict in his statement already cited, is no more universally correct than it would be for discission of the thin membrane after extracapsular lens extraction. In brief, the posterior capsule of the lens is not necessarily in contact with the vitreous since, in most eyes, a true retrolental space exists. This space is still present if the posterior capsule has been preserved. By careful technique one can often incise the membrane without puncturing or incising the vitreous.

SUMMARY AND CONCLUSIONS

The surgical problems encountered in congenital cataract, especially in patients

between the ages of one and six years, have been discussed, and it has been proposed that an ideal method, contrary to most of the previously used methods, should obtain complete absorption of the lens nucleus and cortex, in the pupillary zone, within four to eight weeks, with a single operative procedure, and with only slight danger of undue reaction or increased tension. Furthermore, special emphasis has been placed on the importance of preoperative, maximal dilatation of the pupil, and upon the danger of incising the vitreous, either by accident or by design, as in the Ziegler operation. Linear extraction in this age group is disparaged, principally because of the danger of iris prolapse, although it is recognized that at later ages some form of extraction will be necessary. It is planned to deal with this subject in a subsequent paper.

The author's method of modified discission, in which the lens cortex and nucleus are divided into small fragments and these are then displaced, by means of the irrigator,* from the capsular sac into the anterior chamber is proposed as an approach to the ideal operative procedure for the age group cited. Although, to date, the method has only been applied in six eyes of three patients, the surgical results have been so uniformly good that it seems worth while to publish it. It is hoped that this method will be tried out by many operators in a large number of cases, for this is the only means by which a final evaluation of its true worth can be made.

Both a priori and judging from experience, there seems no need to postpone operation for congenital cataract beyond the age of two years, as a general policy; or, in bilateral cases, to interpose an artificial interval between operation on the first and second eyes.

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ELECTROENCEPHALOGRAPHY AND OPHTHALMOLOGY*

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HISTORY

Electroencephalography is the technique of recording the electrical beat of the brain. The study of the electrical activity of the brain began in 1874 when Caton, an English scientist, discovered evidences of electrical fluctuations in the brain of living animals.¹³ In 1902 and 1907, Hans Berger, father of modern electroencephalography, recorded spontaneous rhythmical fluctuations in the electrical potentials from the brains of animals and, in 1930, was successful in recording evidence of the electrical activity of the human brain.⁷ He showed that normally the beat of the brain appears as a mixture of more or less sinusoidal fluctuation in voltage with a frequency of from 1 to 60 per second and that the most commonly recorded rhythm

has a frequency of approximately 10 per second in normal adults (fig. 1). Berger proved that this electric rhythm came from the cortex and called the record the electroencephalogram.

Gibbs and Gibbs,^{15, 16, 17, 18, 19} and William Lennox^{16, 28} have been the most prominent American investigators in this field, and their research has made this method of investigation useful in clinical neurology. Their work was greatly aided by the construction of a reliable and sturdy instrument by Grass, using magnetic inkwriters for the recording of the brain waves. Within the past 10 years, over 2,000 publications and some exhausting treatises on the subject of electroencephalography have been written. The outstanding reference is Gibbs and Gibbs's "Atlas of Electroencephalography,"¹⁵ which deals authoritatively with all aspects of clinical electroencephalography. Besides the numerous research publications, there are other excellent general references, such as Lindsley's,³¹ which stresses the physiologic and psy-

* Presented at the 15th scientific meeting of the Association for Research in Ophthalmology, Inc., at San Francisco, July 2, 1946.

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chologic aspects; Jasper's,^{22, 23} with its consideration of the epilepsy problem; and Hoefer's,²¹ Williams and Gibbs's⁵⁰ on the use of electroencephalography in the diagnosis and prognosis of head injury. The most important research on the localization of cerebral lesions was done by Walter,⁴⁹ and by Gibbs, Wegner, and

becomes faster and shallower with stimulation, and by attention. It becomes faster with increasing age. Electroencephalograms (EEG) vary considerably from one person to another and are not always constant in the same person.

Some confusion exists in EEG nomenclature, and many investigators now

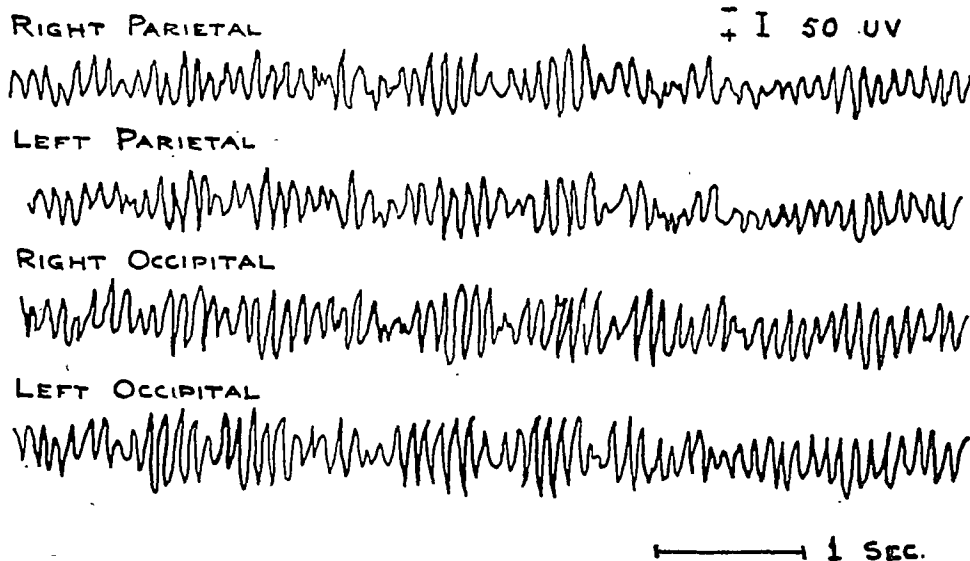


Fig. 1 (Callahan and Redlich). Normal electrical rhythm of the brain. Tracings from four areas are made simultaneously. Monopolar lead.

Munro.^{18, 19} Berger's original articles remain the basic source of reference.

PHYSIOLOGY

The electroencephalogram records electrical brain activity from the surface of the scalp, just as the electrocardiogram records that of the heart from the chest wall. Voltage of the former is much smaller, however, being approximately one hundredth of that of the heart. Gibbs and Gibbs point to the similarity of the electrical rhythm of the cortex and the activity of the respiratory center; for example, respiration and brain waves (although 60 times faster than respiratory frequency) are both slowed considerably by sleep, sedatives, and low carbon-dioxide mixtures. The beating of the brain

avoid, wherever possible, the original designation of alpha, beta, or gamma waves. Gibbs has suggested a classification of waves based on their frequency, amplitude, and appearance. Normal frequencies in adults are from $8\frac{1}{2}$ to 12 per second; pathologic brain waves are classified as slow, very slow, fast, very fast, and paroxysmal, the latter occurring in a large percentage of convulsive disorders. The amplitude varies from 5 to 150 microvolts, the normal limits ranging from 10 to 50. The appearance is usually sinusoidal, but may be spike-like, or wave and spike, and similar combinations.

Like the electrocardiogram, the maximum diagnostic and prognostic value of the EEG is attained when it is combined with other types of clinical and laboratory examinations.

CLINICAL APPLICATION

Electroencephalography has become useful in neurologic diagnosis and has found widespread application. Its greatest usefulness lies in the following fields: (1) the diagnosis of convulsive disorders;⁴⁵ (2) the diagnosis and prognosis of head injuries, particularly those accompanied by convulsive seizures;²¹ (3) the

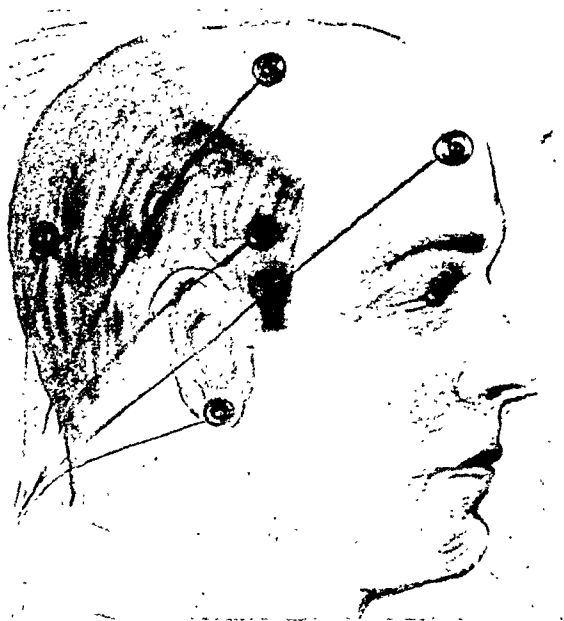


Fig. 2 (Callahan and Redlich). Position of leads for recording of electrical discharges from frontal, parietal, temporal, and occipital lobes. The lead on the ear is the "ground."

diagnosis and localization of expanding intracranial lesions, such as tumors, subdural hematomas, and brain abscesses;^{18,46} (4) the diagnosis of narcolepsy, of some types of encephalitis, and of the residuals of meningitis;⁴⁵ (5) it may be helpful in the diagnosis of diffuse, inflammatory, or degenerative conditions of the brain, in some organic psychoses, and it eventually may be of help in the diagnosis of personality disorders.³¹

TECHNIQUE

Small solder electrodes are affixed directly to the scalp without cutting or shaving the hair (fig. 2). The standard arrangement adopted in most laboratories,

including Army and Navy installations, is to use eight electrodes, with two ground electrodes attached to the ears (U. S. Army T.B. Med. Bulletin No. 74). For localization, ground electrodes are usually dispensed with, and the brain waves are recorded by the bipolar method. The electric current passes by conduction from the cortex through the skull and scalp to the solder electrodes, whence it goes to the switch box and to the amplifying units. The voltage of the brain waves is amplified about 10 million times, and the fluctuation is recorded on paper tape which moves past a recording point at a constant rate. Each lead is recorded separately, and on standard models, the brain waves from four to six channels may be recorded simultaneously. It requires 20 to 30 minutes to affix the electrodes, and the patient is instructed to lie on a cot or sit in a comfortable chair in a room properly screened from outside electrical interference. An EEG can usually be recorded in 30 minutes. We have employed the standard eight leads in studying certain eye problems, and in others we have affixed an electrode to each supraorbital region and (one) to each infraorbital region and used the bipolar method of recording.

APPLICATION OF ELECTROENCEPHALOGRAPHY TO OPHTHALMOLOGY

The aforementioned investigations are reported in special publications such as those of general biology, physiology, psychology, neurology, and psychiatry. Some have appeared in the general medical journals but very few in the ophthalmic literature.

Several problems of primary interest to ophthalmologists are: (1) local electrical discharges following eye opening and closing and eye movements; (2) effect of visual stimulation and eye opening and closing on the occipital electroencephalogram; (3) diagnosis of false

(hysterical or malingered) blindness; (4) localization of cerebral lesions with visual defects.

LOCAL ELECTRICAL DISCHARGES FOLLOWING EYE OPENINGS AND CLOSING, AND EYE MOVEMENTS

It has long been known that a constant electric-potential difference is present in the intact or enucleated eye, and that the cornea is always positive and the posterior half of the globe is negative. Adler¹ compares this to the demarcation current in the muscle of a frog's leg, and Duke-Elder¹⁴ believes that this difference in electrical potential is the registration of the difference in potentials which exist on either side of the membranes through which the intraocular fluid dialyzes. Miles^{36, 37, 38} has shown that the steady potential from the eyeball can be measured by making use of the eye's motility, electrodes being applied above, below, and lateral to the orbits. The measurable ocular polarity potential of the human eye *in situ* is in the order of 1.0 millivolt when the eye rotates laterally 30 degrees from the primary line of regard; the range between supposedly normal subjects is from about 0.3 to 2.5 millivolts. Mowrer, Ruch, and Miller³⁹ recorded potentials with a galvanometer, and since they were able to abolish them by destruction of the retina of rabbits with hydrochloric acid, considered them due to the corneoretinal potential. Redlich, Callahan, and Schmetje⁴³ have examined 40 patients (table 1) with various injuries and diseases of the eye, recording the electric potentials from supraorbital and infraorbital leads with the electroencephalographic apparatus. (These fluctuations are from the eye potential, and are not brain waves.)

Eye opening and closing, or blinking. The blink reflex is a sudden, firm closure of the lids, in which the superior rectus

contracts to pull the eye up, the levator relaxes, and the orbicularis contracts firmly to close the lids.

In patients with normal visual apparatus, blinking of the eye caused 2- to 4-per-second sinusoidal waves of 60 to 150 microvoltage, seen best in the frontal leads, occasionally in the other leads.

TABLE 1
TYPES AND DISTRIBUTION OF OCULAR LESIONS
USED FOR EXPERIMENT

Unilateral traumatic anophthalmos (operative enucleation)	16
Unilateral traumatic anophthalmos (operative evisceration)	10
Bilateral enucleation	1
Bilateral evisceration	1
Unilateral complete destruction of orbit, eyelids, and anophthalmos	2
Primary peripheral facial paralysis with lagophthalmos	2
Unilateral optic atrophy with amaurosis	2
Unilateral avulsion of the optic nerve	2
Unilateral traumatic chorioretinitis	2
Unilateral optic neuritis, cause unknown	2
Total	40

They are regular, smooth, and differ radically in their appearance from muscle-potential discharges, which result from action of the palpebral, orbicular, frontal, and temporal musculature.

In patients with unilateral anophthalmos (enucleations and eviscerations), the potential from the anophthalmic side was either very weak or absent (fig. 3). When present, it is probably due to the spread of potentials from the normal side. No blink waves were seen in a case of bilateral evisceration or in a case of bilateral enucleation.

In patients with unilateral optic neuritis and extensive chorioretinitis, the potentials following blinking were of a similar nature and order from both affected and normal eyes. Normal blink waves were obtained in the complete absence of light perception.

Eye movements. Lateral and vertical spontaneous and voluntary eye move-

ments result in only small deflections as recorded on the electroencephalogram, and they are identical with those obtained when the eyeball is moved passively with a forceps. In patients with a unilateral evisceration or enucleation, no potentials

not due to muscle currents. This finding is in corroboration of the work of Miles and Mowrer, Ruch and Miller.

In addition to the steady potential of the eye, an action current is formed when light falls on the retina. This current

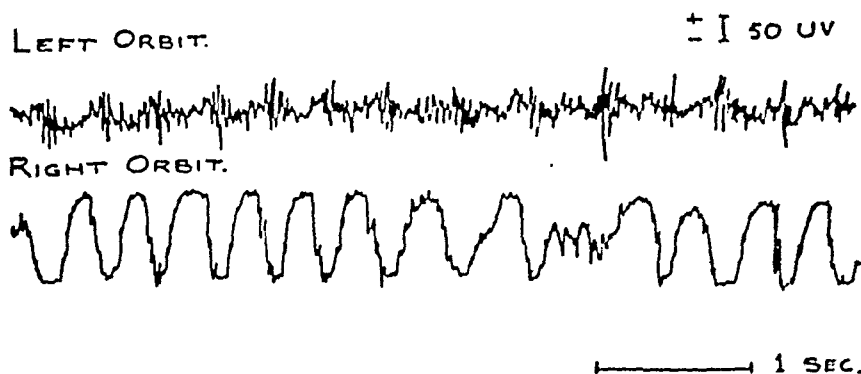


Fig. 3 (Callahan and Redlich). Patient 446; left eye has been eviscerated. Leads were placed at the orbital rim of each side, and the patient was instructed to blink eyelids rapidly. The large sinusoidal waves as recorded from the right orbit are the so-called "blink waves." This finding suggests that the retina is essential for movement discharges.

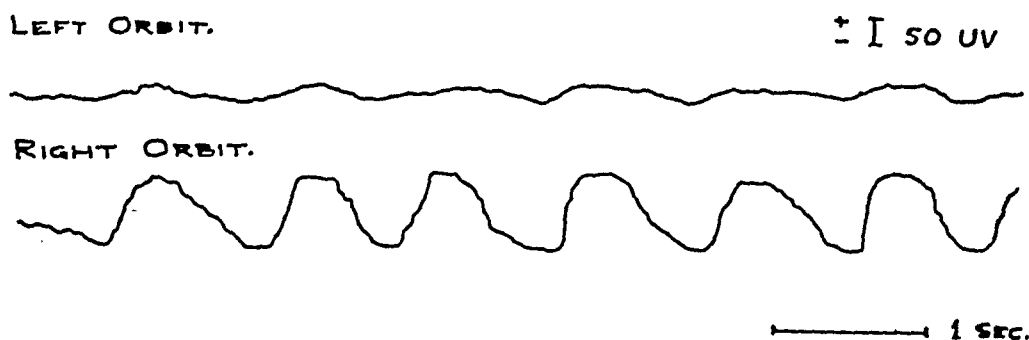


Fig. 4 (Callahan and Redlich). Patient 597; left eye has been eviscerated. Leads placed at orbital rim of each side, and patient instructed to roll his eyes about. This finding also suggests that the retina is essential for movement discharges.

were observed on the injured side after active or passive eye movements (fig. 4). In patients with optic neuritis and chorioretinitis, there were normal potentials after eye movements. Studies of the electrical component of nystagmus have been made but no typical electrical phenomena could be recorded on the electroencephalogram upon eliciting optokinetic nystagmus in normal eyes.

Therefore, it seems quite certain that the electrical potentials which occur are due to the corneoretinal potential, and are

can be registered in the form of an electroretinogram, which shows the short latent period after the stimulus and then a short negative phase followed by the sharp, large, positive deflection that subsides slightly and is succeeded by a much slower, longer, positive phase. The optic nerve, although a part of the central nervous system, responds to stimulation remarkably like a sensory nerve. The latent period after stimulation of light is considerably longer than the latent period of retinal current, and Adrian found that

the latent period could be considerably shortened by increasing the size of the retinal image, which implies that the various points in the retina are linked together. There has been considerable scientific interest in the phenomenon of the eye's photoelectric response to light, but in none of our studies did we record electroretinograms, and it is mentioned only as a preliminary to consideration of the following sections, which deal with

cedures which stimulate the subject result in a change of the occipital rhythm.

Redlich, Callahan, and Mendelsohn⁴⁴ found, in a study of 30 patients with normal brain waves, that opening the eyes in complete darkness or in a lighted room usually had about the same effect, although the rhythm returned to the pre-stimulation rate more quickly in the dark than when the eye was opened in daylight (fig. 5). This suggests the exist-

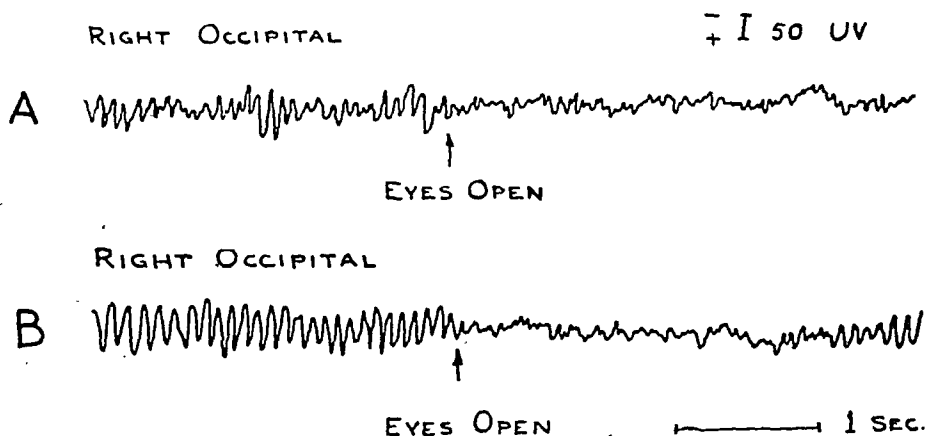


Fig. 5 (Callahan and Redlich). Patient 869; no abnormality of visual mechanism. A, EEG tracing in daylight. B, EEG tracing in darkness are identical except for quicker return of original (closed-eye) rhythm in darkness. Monopolar lead.

the resultant effects upon the cerebral cortex of the action of light upon the retina.

EFFECT OF VISUAL STIMULATION ON THE OCCIPITAL RHYTHM

(1) *Single visual stimuli, by eye opening and closing.* Berger^{7, 8} reported that visual stimulation by the opening of the eyes in a lighted room altered the occipital-brain rhythm, but that opening of the eyes in a darkened room did not change it.

Jasper and Cruikshank^{22, 23} found an increase in frequency of the brain waves after opening the eyes in a lighted room but mentioned that sometimes opening of the eyes in the dark produced similar results. Williams⁵¹ showed that not only visual stimulation but other pro-

ence of additional factors besides the stimulus of light on the retina in the production of altered occipital rhythm. It is unlikely that the factor of attention alone accounts for this, for only 9 of 42 patients showed changes when, with eyes closed, they were asked to visualize some person or object.²⁰

Changes of the occipital rhythm after visual stimulation caused by the opening and closing of eyes in daylight were studied in 100 patients with normal vision, 32 patients with unilateral blindness, 3 blind patients, and 9 patients with homonymous hemianopia.

In 10 of 11 patients with unilateral blindness (enucleation) and with normal electroencephalographic rhythm, opening of the lid of the anophthalmic side had about the same effect on the occipital

rhythm as opening the eye on the normal side.

No changes in the occipital rhythm after opening the eye were noted in three patients with normal alpha rhythm, who were blind because of bilateral exsiccation or enucleation.

We attempted to discover some characteristic EEG finding in amblyopia ex anopsia. In 10 such patients whose records we studied, the occipital rhythm was normal, and there was no difference in the occipital waves when the normal and when the amblyopic eye was stimulated in turn by a weak light, a bright light, by reading, and by reviewing a picture.

(2) *Repeated visual stimuli.* Although other investigators have previously noted that repetitive photic stimulation of the retina induced changes of the occipital waves, Adrian and Matthews² were the first to use photic driving to modify the normal occipital rhythm. They found that photic driving in man was most apparent when the rate of photic stimulation was between 10 and 20 cycles per second. Synchronous records of the occipital and temporal alpha rhythm show that the occipital alpha waves can thus be made to follow a flickering light; whereas, the frontal alpha waves retain their original rhythm and are unaffected by it.

Bartley,^{3,4,5} Bartley and Bishop,^{6,9} and Bishop and O'Leary^{10,11,40} showed that response to controlled stimulation of the retina or the optic nerve emerges in the cortical record as a quite definite wave complex. To insure the most condensed response by eliminating the complications due to repeated sense-cell discharge, in the experiments of Bishop and O'Leary the optic nerve was stimulated directly. They found that the stimulus drives the cortex by instituting a series of waves which are similar to alpha waves but out of phase with the preëxisting alpha waves

and sometimes entirely supplanting them. It is, therefore, possible that the peripherally induced cortical activity and the preëxisting waves occupy the same group of cells in the same way and that direct stimulation may initiate an alpha rhythm.

USE OF THE ELECTROENCEPHALOGRAM IN DISTINGUISHING TRUE FROM FALSE BLINDNESS

The fact that most individuals with normal visual systems will show EEG changes upon opening the eyes has led Lemere²⁷ to conclude (unjustifiably) that it is a method of differentiating true from false blindness with certainty.

TABLE 2
CHANGES IN THE OCCIPITAL RHYTHM FOLLOWING
OPENING OF THE EYES IN DAYLIGHT

	Amplitude	Frequency
No change	12	20*
Slight change	16	51
Moderate change	31	10
Marked change	41	19

* All 12 of the cases showing no change in amplitude are in this group of 20.

As stated previously, the effect on occipital rhythm of visual stimulation caused by opening and closing the eyes in daylight were studied in 100 patients with normal vision. The findings are shown in Table 2. From these, it is evident that most persons with normal occipital rhythm and with normal visual apparatus do show changes in the occipital rhythm when the eye is stimulated by light; but it is also evident that there are exceptions (fig. 6). Therefore, the effect on the EEG caused by opening and closing the eyes does not permit a consistently valid differentiation between true and false (hysterical and malingered) blindness, and this method of testing has no medico-legal value.

However, it was observed that the moderate and marked changes in ampli-

tude and frequency occurred mostly in patients with a well-defined, regular occipital rhythm of about 10-per-second frequency. The same was true, although less marked, in the slow groups. In many patients with fast rhythms, the changes after opening the eyes were usually less pronounced or absent. Abnormal waves of diagnostic significance in epilepsy and similar affections showed a tendency to disappear after the eye was opened; after a few moments, some would reappear. But

This consists of stimulating the eye with a powerful source* of light and recording the galvanic skin response with a Grass electroencephalograph. The galvanic skin response is the bioelectric current accompanying sweat-gland and vasomotor activity induced by sensory stimuli, attention, and various types of psychologic situations. Landis²⁵ has reviewed the various methods used. A new method of recording it with the EEG has been described by Redlich,⁴¹ in order to differ-

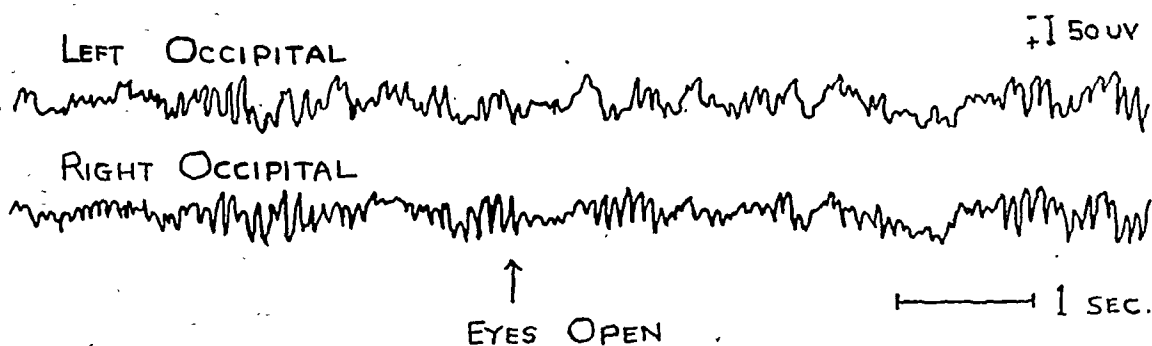


Fig. 6 (Callahan and Redlich). Patient 204; no abnormality of visual mechanisms. Eye opening causes no appreciable change in rhythm or amplitude.

in general, open-eye records were of much less diagnostic aid than was the standard record with the patient's eyes closed.

In 42 patients, we recorded normal EEG changes after the eyes were opened. A card was then held before the patient, and he was asked to read. In 13 of these patients, changes were more marked and more lasting than the changes after the eyes were opened, and in the other 29 they were relatively the same. This variance makes it difficult to arrive at any conclusion in regard to EEG changes with varying use of the eyes. Nor did we find a difference in the normal occipital rhythm after stimulation of the normal eye and fellow eye with advanced pathologic change (such as massive chorioretinitis or optic atrophy).

In a different set of studies, we have used the EEG as a test of light perception to differentiate true from false blindness.

entiate organic from hysterical anesthesia in patients with traumatic injuries of peripheral nerves and spinal cord.

Our tests were carried out in a completely darkened room with the patient resting on a bed. The bioelectric currents were obtained from one solder electrode fastened to the palm with adhesive tape and another electrode attached over a scratched area of skin of the forearm. Bipolar recording was used. Attenuations were set from 7 to 10 on the scale. Low-frequency filters were set on M, and high-frequency filters on four. The tracing was a fairly straight line. After stimulation of the eye with an intense light, a deflection was noted when visual perception was present. The same stimulation of the totally blind eye induced no response (fig. 7).

*3,000 foot-candles on the eye at a distance of 3 feet.

We examined 26 patients with unilateral blindness and were able to obtain a response from the normal eye in all cases; whereas, no response was obtained after visual stimulation of the blind eye. We did not have the opportunity to observe patients with hysterical or malingered blindness. But, from the work of Levine,^{29, 30} and Marquis and Williams,³⁴ it is to be expected that visual stimulation of a patient with hysterical or malingered blindness would elicit a nor-

ported a series of five brain tumors involving the optic pathway. In each of the cases, there was a loss of normal occipital rhythm over the affected area. Traumatic homonymous hemianopia was studied by Redlich, Callahan, and Mendelsohn.⁴⁴ They reported 12 patients with injury to the parietal, temporal, and occipital lobes with residual hemianopia or quadrianopia to have the following responses: Focal abnormalities were present in seven; generalized EEG abnormalities in three; and

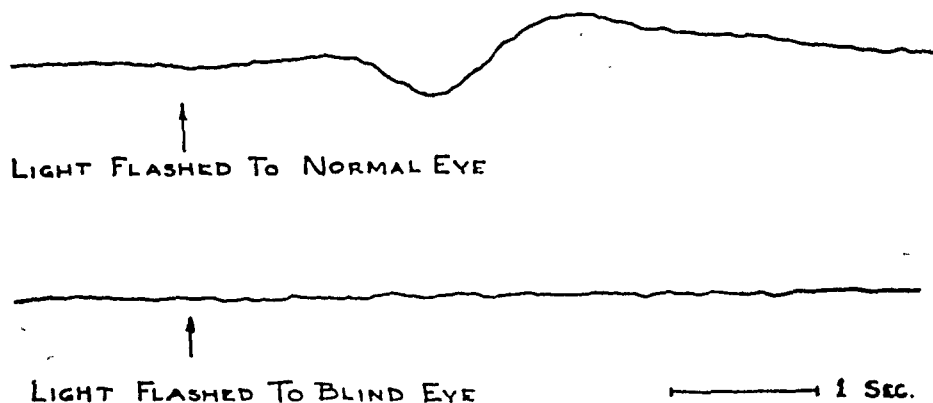


Fig. 7 (Callahan and Redlich). Patient 818; left eye completely blind due to traumatic retinal hemorrhage; right eye normal. Galvanic skin response recorded with electroencephalograph after stimulation of normal and blind eye with 3,000 foot-candles at 3 ft. Monopolar lead.

mal GSR, and thus this method would permit differentiation of organic and psychogenic blindness.

LOCALIZATION OF CEREBRAL LESIONS WITH VISUAL DEFECTS

When a lead is placed near cerebral lesions, such as neoplasms or encephalomalacias, which are superficial in location, the waves from this area are generally slow, and if recorded by the localizing bipolar method, can be shown to be "out of phase." By these characteristics, it is possible to determine the approximate location of a superficial lesion (figs. 8 and 9.) In very extensive destruction of cerebral tissue, no brain waves can be recorded at all.

Homonymous hemianopia caused by tumors were studied by Case,¹² who re-

ported a series of five brain tumors involving the optic pathway. In each of the cases, there was a loss of normal occipital rhythm over the affected area. Traumatic homonymous hemianopia was studied by Redlich, Callahan, and Mendelsohn.⁴⁴ They reported 12 patients with injury to the parietal, temporal, and occipital lobes with residual hemianopia or quadrianopia to have the following responses: Focal abnormalities were present in seven; generalized EEG abnormalities in three; and

SUMMARY

1. A brief résumé of the history of electroencephalography are presented.
2. Some of the physiologic facts of electroencephalography are presented.
3. The clinical use of the electroencephalogram in neurologic diagnosis is outlined, especially as it concerns various convulsive disorders and localization of

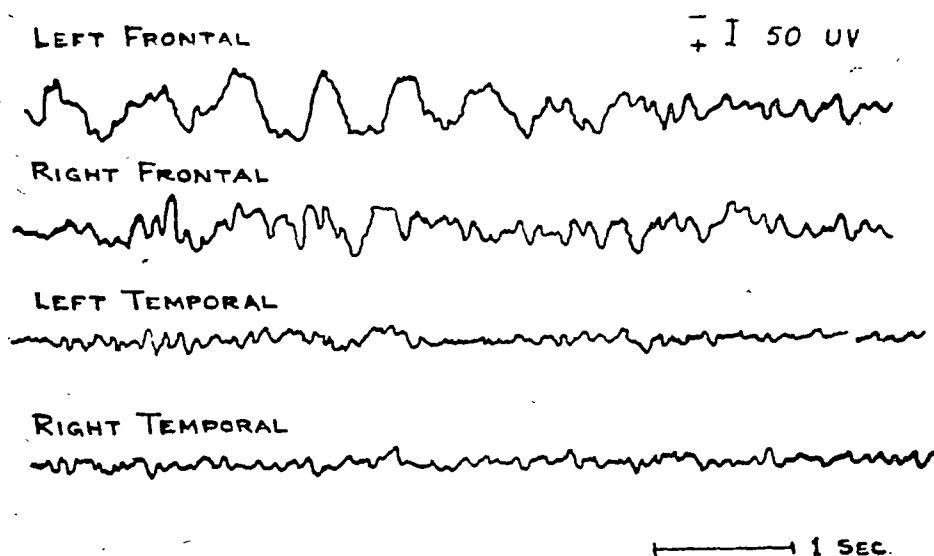


Fig. 8 (Callahan and Redlich). Patient 773. Standard leads. Slow-wave focus in left frontal area. Clinical and pathologic diagnosis: astrocytoma of the left cerebral hemisphere. Monopolar lead.

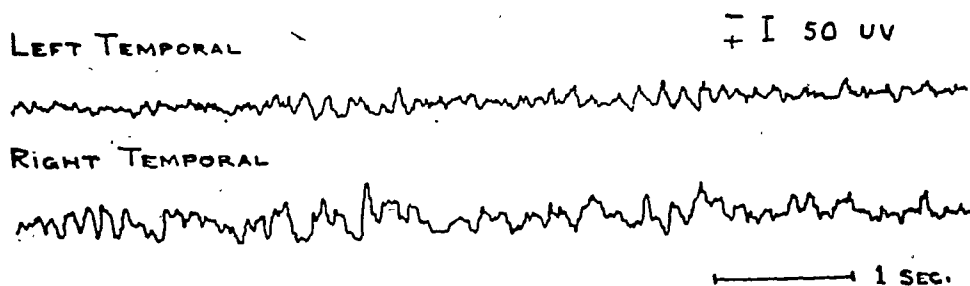


Fig. 9 (Callahan and Redlich). Patient 232; right temporal lobe injured by shell fragment, with left homonymous hemianopsia. EEG shows slow-wave focus in right temporal area. Monopolar lead.

focal cerebral lesions.

4. The technique of recording an electroencephalogram is described.

5. The application of electroencephalography to ophthalmology is discussed as follows:

(A) The use of the EEG to record changes of electrical eye potentials following eye movements. These potentials can be observed only when the retina is present and are thought to be due to the corneoretinal potential difference.

(B) The effect of visual stimulation and the opening and closing of eyes was studied in 100 patients, and an incon-

clusive statistical scatter of findings resulted. In investigating the effect of the visual stimulus on the normal occipital rhythm, we found, in a study of 30 patients with normal brain waves, that opening and closing the eyes in the dark and in the light had similar effects. The normal occipital wave in man can be driven by repetitive photic stimulation of the retina. No characteristic finding was discovered in 10 cases of amblyopia.

(C) The effect of opening the eye on the normal occipital rhythm does not differentiate true from malingered or hysterical blindness.

(D) We have employed the electroencephalogram to record the galvanic skin response after visual stimulation and, in this manner, true blindness can be differentiated from false blindness.

(E) The electroencephalogram is an aid in localizing cerebral lesions with visual defects. Superficial lesions, especially tumors, frequently show slow waves.

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DISCUSSION

DR. CLYDE A. CLAPP (Baltimore, Maryland): Dr. David Harrington wishes to know: "Was there any correlation between the EEG finding and congruity of the visual fields in antero-posterior localization of cerebral lesions?"

DR. CALLAHAN (closing): The question refers to the hypothesis that the more posterior the lesion is located, the more

congruent are the field defects, and Dr. Harrington wishes to know if we found evidence to support or disprove this theory. We did not make a study of our cases for this relationship. Case has reported seven cases of homonymous hemianopsia, proved at surgery to have tumors of the optic tract, which showed a loss of normal occipital rhythm over the occipital cortex.

HEREDITARY NYSTAGMUS OCCURRING AS A SEX-LINKED CHARACTER RECESSIVE IN THE FEMALE*

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Hereditary nystagmus appears as a constant, horizontal, to-and-fro movement of the eyes, pendular in type, at the rate of about 120 beats per minute, of small excursion on forward gaze and coarser on looking to the sides. Even among members of the same family it varies somewhat in rate and amplitude; it may show a quick component on lateral gaze, and may be more pronounced on turning the eyes to one side than when they are turned to the other. Visual acuity is usually fairly good, generally 20/30 to 20/50, in spite of the constant motion of the eyes, and would probably be still better if only the eyes could be made to stand still. Reduction in visual acuity seems not to be the cause of the eye movements, yet the nystagmus is somewhat similar to that resulting from defective vision.

Hereditary nystagmus must be distinguished from nystagmus due to such conditions as congenital cataracts, corneal scars, macular lesions, and albinism. In all of these conditions, visual acuity is reduced for reasons evident to the examiner. In hereditary nystagmus, the eyeballs are normal, and there is no significant refractive error. In some cases, there is an accompanying shaking of the patient's head.

Nystagmus is said to be inherited in any one of several different ways—as a Mendelian dominant or recessive character, or as a sex-linked character. In most reported families, it seems to be transmitted in a partially sex-linked fashion, as in the first family described in

Nettleship's¹ paper in 1911. In that author's second family, it was transmitted as a sex-linked character entirely recessive in the female, as it was in the cases to be reported herein. The literature contains descriptions of relatively few families of this latter type, one of them being that of Waggoner and Boyd² published in 1942. Since these authors appended a list of pertinent references to their report, its repetition is unnecessary here.

REPORT OF CASES

The propositus of the family to be reported herein was a 7-year-old boy (individual 27 in generation VI in figure 1) whose father brought him to the Clinic to have an operation performed on his eyes to steady them. The father stated that ever since the boy's birth his eyes had been in constant motion. On examination there was apparent a small, rapid, horizontal, pendular nystagmus. When the boy turned his eyes beyond 20 degrees to each side, the movements became coarse and less rapid. The refractive error was slight. Visual acuity could not be determined accurately because the boy had not attended school and was shy, but it was definitely better than 20/70.

The father said he had another son (individual 30 in generation VI in figure 1) aged two years, who was similarly afflicted. The nystagmus had been noted "at birth." On examination of this 2-year-old boy a short time later, I found that his condition resembled that exhibited by individual 27 in generation VI. Neither of these boys showed any shaking of the head.

The father said that these boys had a

* From the Section on Ophthalmology, Mayo Clinic.

cousin (individual 24 in generation VI in figure 1), the son of a sister of the boys' mother, who had the same sort of trouble with his eyes. I found that the cousin in question was 7 years of age and that the movement of his eyes had been first discovered by his parents when he was six months old. Nystagmus on forward gaze was horizontal and pendular, small

nystagmus. These cousins were sons of another sister of the mother of individuals 27 and 30. Since these two cousins lived several hundred miles away, I had to rely on their mother for a description of their eyes. Individual 19 in generation VI in figure 1, now a boy 10 years of age, has eyes that have been "terribly active" since the age of three months, when he had

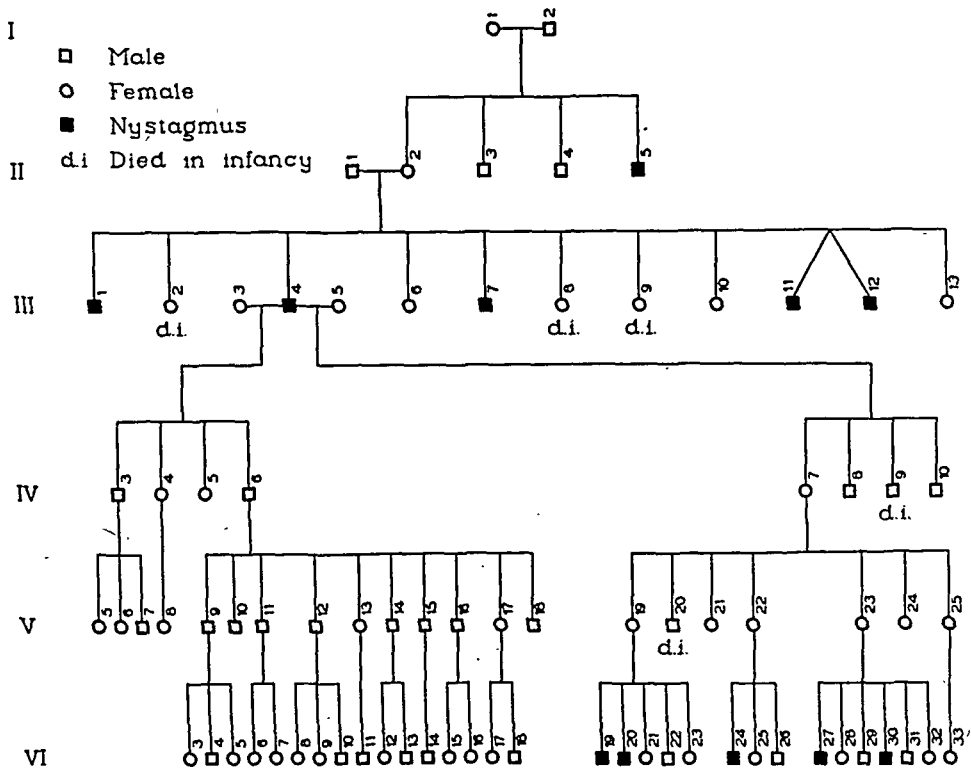


Fig. 1 (Rucker). Genealogic tree showing descendants of individual 4 in generation III. This individual was married twice (to individuals 3 and 5 in generation III).

in amplitude, and coarse on the patient's looking to the sides. Its rate was about 120 beats per minute, although at times it stopped altogether. There was an accompanying side-to-side shaking of the head, a negation movement, not synchronous with the eye movements. The jerking of the head and eyes was thought by the parents to be lessening, but became pronounced when the boy was tired. Visual acuity was 20/30 in each eye.

The two boys first mentioned (individuals 27 and 30 in generation VI in figure 1) had two other cousins who also had

pneumonia. Individual 20 in generation VI in figure 1, an 8-year-old boy, also has "jerky eyes," first noticed at the age of 6 years, when he had measles.

I examined most of the brothers and sisters of these afflicted boys, and their parents and some of their grandparents, without encountering any further evidence of nystagmus. Not until I examined the half brother (individual 6 in generation IV of figure 1) of the grandmother of the nystagmic boys did I obtain further clues. This half brother himself had normal eyes, as did all his children and

grandchildren (fig. 1), many of whom I examined personally. This half brother, however, told me that his father had the type of jerking of the eyes that I was seeking. With that clue, it became possible to work out the complete family tree.

The father (individual 4 in generation

they, too, were born with nystagmus. Although I have no information about this brother's parents (individuals 1 and 2 in generation I in figure 1) except their names and dates of birth, it will become apparent, after their descendants have been traced, that they must have had nor-

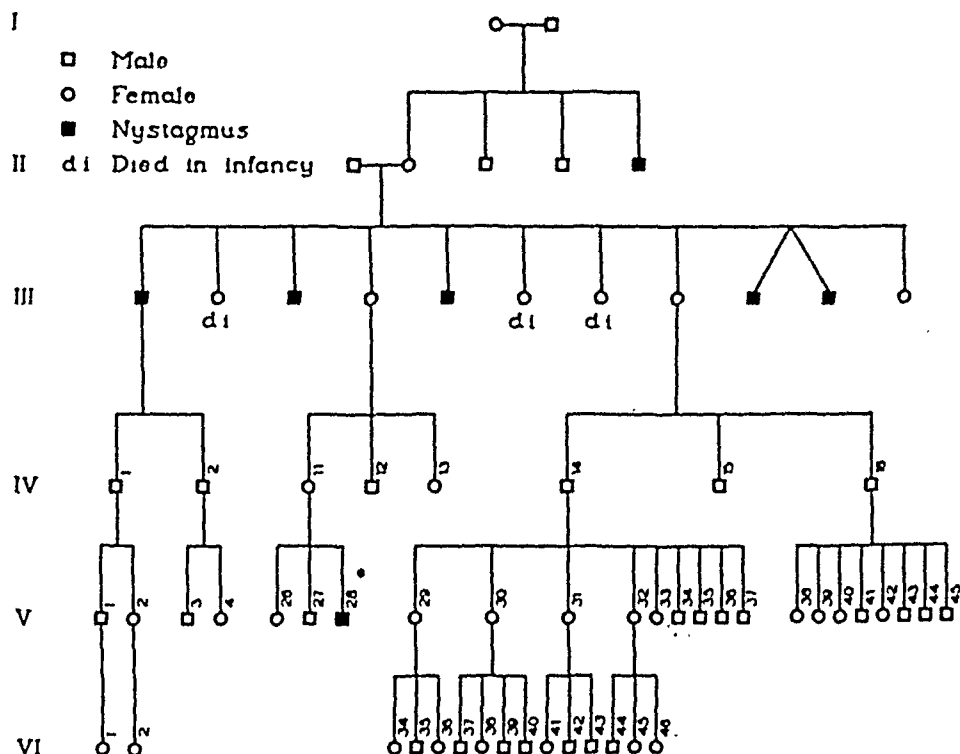


Fig. 2 (Rucker). Descendants of additional members of generation III: those numbered 1, 6, and 10 in figure 1. Generations I, II, and III are repeated.

III in figure 1) of this half brother had been married twice. He had 10 brothers and sisters. Every one of his four brothers had nystagmus, whereas all of his sisters were free of it. Their parents (individuals 1 and 2 in generation II in figure 1) had normal eyes, but their mother had a brother (individual 5 in generation II in figure 1), who had nystagmus. This is confirmed by a story in the family that this brother (individual 5 in generation II in figure 1) was visiting his sister shortly before she was delivered of the twins (individuals 11 and 12 in generation III in figure 1), and that "he cast his mark on them," with the result that

mal eyes and that the mother (individual 1 in generation I in figure 1) was a carrier.

In figure 2, the eldest male in generation III is said by all who knew him to have had constant side-to-side shaking of his eyes and his head. He had two sons (individuals 1 and 2 in generation IV in figure 2), both of whom had normal eyes, as have all of their descendants.

In generation III (fig. 2), the eldest surviving female had normal eyes, and left three children, only one of whom, a daughter (individual 11 in generation IV), married. She has three children, (individuals 26, 27, and 28 in generation

V in figure 2). Individual 28 is a 15-year-old boy who has nystagmus. Although I have not as yet examined him, I have notes made by an ophthalmologist who saw him when the boy was 6 years old. The notes state that the boy has a "searching type" of nystagmus, no significant re-

The female next to the youngest in generation III bore three sons (individuals 14, 15, and 16 in figure 2), all of whom have normal eyes, as do all of their descendants (fig. 2).

In figure 3 are shown the descendants of "the twins," the youngest males of gen-

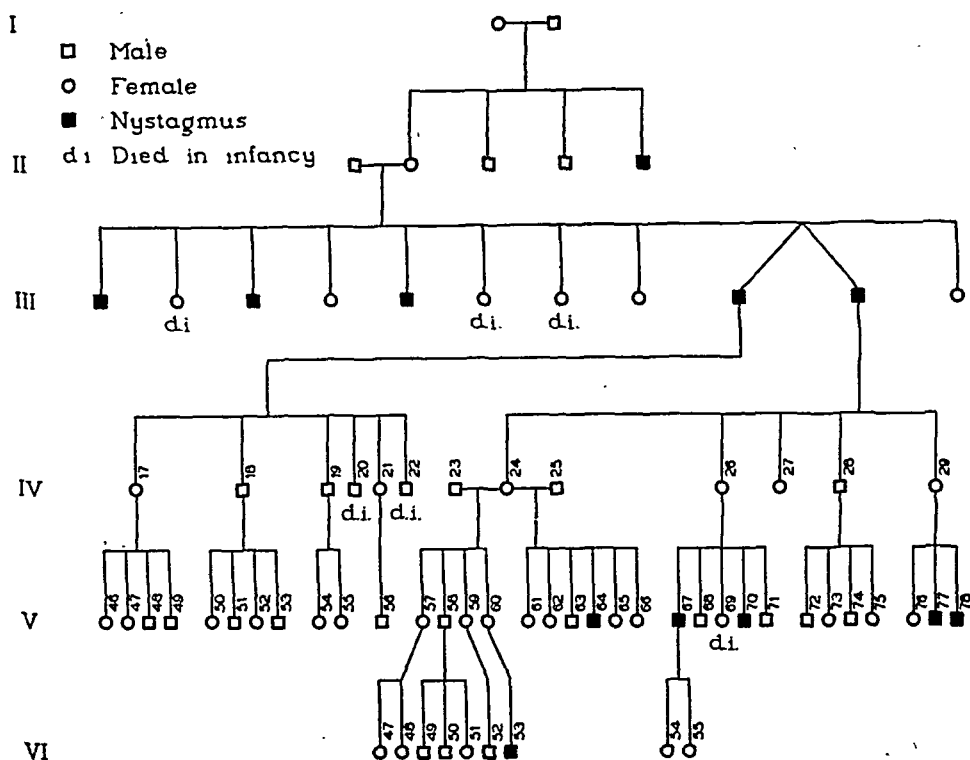


Fig. 3 (Rucker). The descendants of individuals 11 and 12 in generation III in figure 1. These individuals are twins.

fractive error, and that he holds his head to one side when reading. By referring to figure 2, it can be seen that the gene for nystagmus which this boy received passed through four female carriers, all of whom had normal eyes. Not one of his direct ancestors through these four generations exhibited nystagmus, yet he has, without question, an inherited disease.

The third male in generation III (fig. 2), who died at the age of 48 years, is said to have had nystagmus which became more pronounced as he grew older. I do not know whether he had a tremor of the head or not. He left no descendants.

eration III (individuals 11 and 12 in generation III in figure 1). They both dislike physicians so thoroughly that I have been advised not to attempt to examine them. All who have seen them report that both have nystagmus and also constant shaking of the head. One is said to carry his head bent toward his left shoulder, and the head of the other man is reported to be bent toward his right.

The first of the twins has no nystagmic descendants. The second twin has four daughters (individuals 24, 26, 27, and 29 in generation IV in figure 3), all of whom have normal eyes. Of the three daughters

who have married, each has one son or two sons who have nystagmus (individuals 64, 67, 70, 77, and 78 in generation V in figure 3). The eldest daughter (individual 24 in generation IV in figure 3) has a grandson (individual 53 in generation VI in figure 3), a 2-year-old boy, who has constant horizontal nystagmus which becomes coarse on his looking to

with the right eye and 20/50 with the left. With each eye, he can read 14/21 on the American Medical Association reading card. He spent three years during World War II in the supply department of the Army Air Forces.

Individual 70 in generation V in figure 3 is a younger brother of individual 67 of the same generation. He is now 20 years

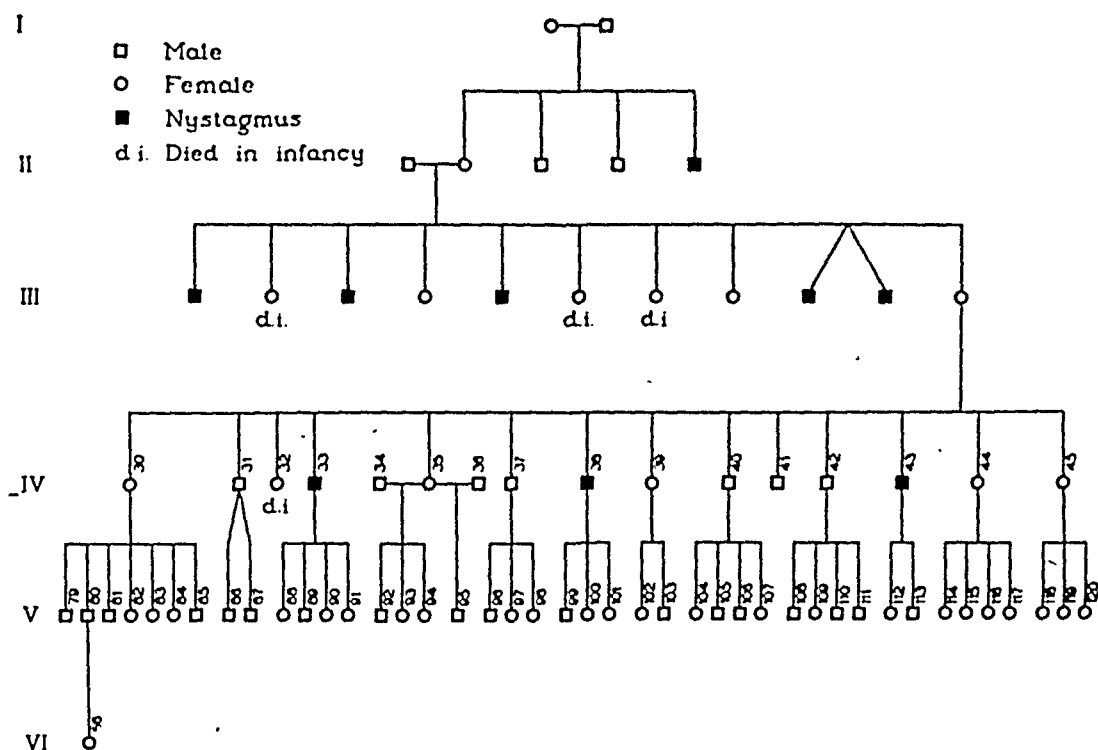


Fig. 4 (Rucker). The descendants of individual 13 of generation III in figure 1.

the left, and diminishes on his looking to the right.

Individual 64 in generation V in figure 3, a 5-year-old boy, has nystagmus, his mother says, only when he is tired or angry.

Individual 67 in generation V in figure 3 is a 25-year-old man who has a pendular, horizontal nystagmus. The movements are short and quick on forward gaze. When this man reads for a time the movements become greater, and a small head jerk appears. Visual acuity is 20/70

of age. He has a horizontal pendular nystagmus. The movements have a small range on his forward gaze, and become coarse on his looking to the sides, more so when he looks to the right than when he looks to the left. When he reads, he tilts the head to the left. There is no tremor of the head. In spite of the nystagmus and several diopters of myopia, his visual acuity with correction is 20/45 in the right eye and 20/40 in the left. He reads 14/14 on the American Medical Association reading card with each eye. He spent

six months of World War II in the Navy, and was discharged because of his ocular trouble.

Individual 77, aged 5 years, and individual 78, aged 1 year, both of generation V in figure 3, are brothers who, their mother says, are afflicted badly with the jerky eyes possessed by several of her relatives.

The only son of the second twin is individual 28 in generation IV in figure 3. He has four children, all of whom have normal eyes.

As shown in figure 4, the youngest female of generation III bore 14 children. Her five daughters have normal eyes; a sixth daughter who died in infancy also had normal eyes. Of her eight sons, three are nystagmic. As yet, none of her grandchildren has shown evidence of nystagmus. The explanation may be that her eldest daughter (individual 30 in generation IV in figure 4), who is the only one with many children, may happen not to be a carrier; and her two youngest daughters (individuals 44 and 45 in generation IV in figure 4) have given birth only to girls. Twenty-two of her 42 grandchildren are offspring of her two sons and would not be expected to be nystagmic.

The first son of this youngest female in generation III to show nystagmus was individual 33 in generation IV of figure 4, a man now 42 years of age. His eye movements are horizontal and pendular. His vision, with correction of one diopter of astigmatism in each eye, is 20/40.

Individual 38 in generation IV in figure 4 is now 37 years of age. His eyes have a constant pendular motion, about 100 beats a minute, which is a slower rhythm than that shown by most of his relatives whom I have examined. As in the case of the others, the movements on looking to either side become coarse. On the American Medical Association reading card he

reads 14/24 with his right eye, and 14/35 with his left. His shuffling gait and clumsy behavior suggest that his neurologic disturbance may not be limited to his eyes.

Individual 43 in generation IV in figure 4, a man 28 years old, is said by members of his family to have a "slight jerking" of his eyes. I have not examined him.

COMMENT

In this family tree in which there are 231 members in 6 generations, 21 individuals had nystagmus. All were males, and all inherited it through females who themselves were not affected. In a number of instances, the gene passed through a chain of several females before it became evident in a male descendant. In no case has a male transmitted the defect to his son. All descendants of nonaffected males are free from the defect. In this family, then, the character is sex-linked, and without exception has been recessive in the females. Its gene is carried in an X-chromosome, as is the gene for hemophilia and that for red-green color blindness.

Nettleship, on the basis of his observations, concluded that in families in which nystagmus was inherited as a sex-linked character, recessive in the female, associated head movements occurred rarely, and that in families in which both males and females were affected, head movements were common. This has not been my experience, for in the family reported herein a considerable number of the nystagmic persons did have associated head movements. Furthermore, in some of my unreported families in which the mode of inheritance is different from that encountered in the present family, I find head movements uncommon. The manner of inheritance seems not to be related to associated head movements.

Waggoner and Boyd in their report called attention to the frequency of associated neurologic disturbances. These were present in a few of the members of the family reported on herein, but could not be classified for want of neurologic examinations. Most of the nystagmic persons seemed to be free from other disturbances, so far as I could judge from their actions. If a competent neurologist had had the opportunity to examine all

had had time to develop. At present, it seems futile to try to guess where within the central nervous system the disturbance lies.

With a complete family tree available, and with the knowledge that in every instance the nystagmus has been inherited as a sex-linked character, recessive in the female, it is now possible to give reliable advice to members of this family. Several have sought such advice and have

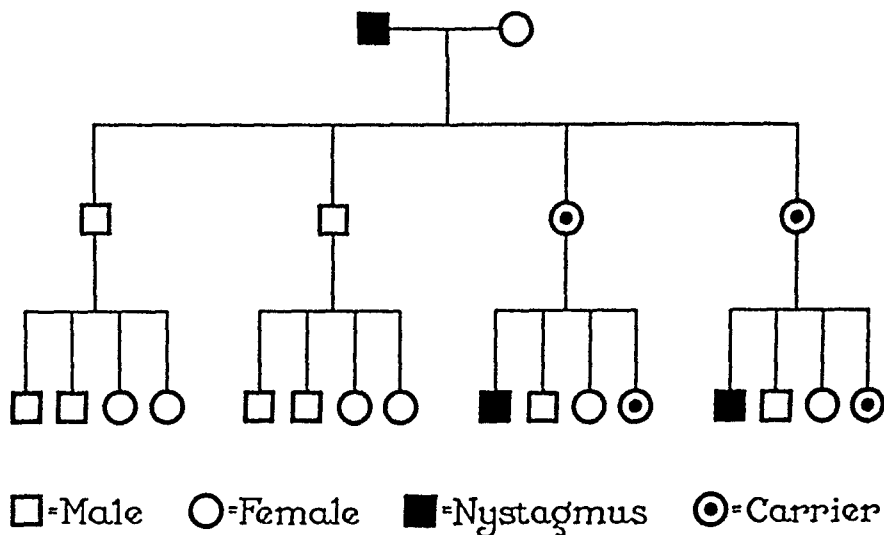


Fig. 5 (Rucker). Diagram of the mode of inheritance of a sex-linked characteristic which is recessive in the female.

members of this family, he might have been able to find some type of disturbance associated with the nystagmus, for the difficulty appears to lie in the central nervous system. Neither albinism, nor high refractive error, nor defective visual acuity can account for the nystagmus, because these conditions were absent in most cases. Furthermore, several mothers were certain that the nystagmus had been present at birth or within a few days thereafter. Since the macula is not completely differentiated until about four months after birth, and evidence of fixation is not present until about the same time, the nystagmus could not have been dependent on any derangement of vision, because it appeared before visual acuity

been grateful for it. As an aid in explaining the transmission of a sex-linked character, the simple diagram reproduced in figure 5 was drawn. It shows that all the children of an affected male will have normal eyes, but that the daughters will transmit the defect to half of their sons. It is well for nystagmic persons to know this. The diagram also shows that all the descendants of normal males are free from this condition, a fact which has given comfort to several such members who feared they might have nystagmic children.

It is unfortunate that in the human race a single characteristic can be transmitted in one of several different ways. Often, one is able to predict the future course of

a hereditary defect only after studying the transmission of that defect through several generations of a family. Once the mode of transmission is known, however,

the future is clear and certain, and the physician is in a position to give helpful advice to members of that family.

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THE INFLUENCE OF BARBITURATE ON VARIOUS FORMS OF NYSTAGMUS*

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One of the signs of mild barbiturate intoxication is nystagmus. This is apparent when the patient turns his eyes on command or when he attempts to look in any direction. Any movement of the globes from the mid position is accompanied by nystagmus. The patient is also unable to maintain his eyes in a deviated position. Apparently, barbiturate in sufficient concentration interferes with normal ocular movement in man.¹ Barbiturates also influence eye movements in cats.² According to Spiegel and Collins,³ the ocular effects (rotation of eyes) are produced by the action of the drug on the brain stem. They suggested that barbiturate anesthesia causes a disequilibrium between the right and left vestibular nuclei and consequent homonymous rotation of the eyes. From their experiments, however, changes in the position of the eyes produced by barbiturate are due not only to the action of the drug on the central vestibular mechanism, but to action on other parts of the brain as well.

* From the U. S. Naval Hospital. The opinions and views set forth in this article are those of the writers and are not to be construed as reflecting the policies of the Navy Department.

The object of this investigation was to determine what effect the barbiturate had on nystagmus and the ocular movements in man. Patients with lesions of the peripheral vestibular apparatus, brain stem, or cerebrum were studied. In addition to this group, patients with various forms of nystagmus were examined after they had been injected with sodium amytal. When possible, the effects produced by intravenous injection of sodium amytal were correlated with the clinically determined lesion. In some instances, however, the nature and location of the pathologic process could not be ascertained, but since the cases revealed what seemed to be pertinent data, they were included in this study. To make the investigation more complete, we also included a series of psychiatric patients who showed no true physical defects and who were given intravenous injections of sodium amytal (narco-analysis and narco-synthesis).†

† Since these patients showed no signs of organic disease (specifically of the visual, oculomotor, or vestibular systems) we considered them as a normal control series. Those individuals who showed hysterical ocular palsies were classified in the pathologic group.

METHOD

Before the administration of the drug, all the patients were examined from the neurologic standpoint. They were also tested with the striped drum for the presence of opticomotor nystagmus.⁴ The alternately black and white stripes, one-half inch in width, were situated on the curved surface of a cylindrical drum, 8 inches in diameter and 10 inches high. The drum was slowly rotated with its axis either in the vertical or horizontal plane, and the patient was instructed to watch the moving stripes in the center of the drum. In the normal individual, this procedure yields a nystagmus known as opticomotor or the "optokinetic" type.⁵ In many instances, these preliminary studies were augmented by Bárány turning, and caloric and galvanic stimulation tests of the semicircular canals. The drugs administered were sodium amytal, sodium pentothal, and sodium luminal. In most cases, however, sodium amytal was used. The drug was injected into the antecubital vein at a rate of 0.1 gm. per minute for a total of 0.3 to 0.5 gm. The patient was seated and engaged in conversation so as to prevent his falling asleep. He was repeatedly asked to accomplish simple tasks which required his visual attention. The ocular findings were recorded chronologically in minutes.

RESULTS

I. NORMAL GROUP

From two to three minutes after the injection of the drug, a slow and coarse nystagmus was observed when the patient attempted to turn his eyes in any one direction. The nystagmus fluctuated in amplitude and rate of ocular excursions. The change occurred every 90 to 120 seconds and was evident during ocular deviation in the horizontal plane. At one period, the nystagmus was more pro-

nounced on right lateral gaze, whereas at another time (90 to 120 seconds later), it was most manifest with the eyes in the left lateral positions.

Opticomotor nystagmus induced by the rotation of a striped drum was invariably abolished about two minutes after the administration of the drug. This physiologic nystagmus remained absent for two and sometimes three hours, even though the patient (a) had a small dose (0.1 gm. of drug), (b) his attention was intact, and (c) his convergence power was preserved.

Comment. All of these findings were consistently present in every normal individual tested. They show that (a) barbiturates produce a nystagmus which seems to fluctuate periodically and is most apparent during ocular deviation, and (b) barbiturate abolishes reflex opticomotor nystagmus.

II. PATIENTS WITH LESIONS OF THE VESTIBULAR NERVE

Case 1. W. H. H., a 19-year-old apprentice seaman, was admitted to the hospital with clinical and laboratory evidence of meningococcic meningitis. He recovered with penicillin therapy. However, during his convalescence, it was noticed that he was very unsteady in his gait and station.

Repeated caloric (cold irrigation of ear canals) and Bárány tests of vertical and horizontal canals failed to yield nystagmus, past pointing, or vertigo. His hearing was only slightly diminished. There was complete bilateral loss of vestibular function in this man.

Opticomotor nystagmus was not tested.

Pharmacologic Tests. Sodium amytal (0.5 gm.) was slowly injected into the arm vein. Within two minutes, definite nystagmus appeared when the patient turned his eyes in any direction except upward. This nystagmus persisted for more

than two hours. During this period the patient was somewhat drowsy.

Case 2. R. D. S., a seaman, second class, aged 19 years, was admitted to the hospital in a comatose state. He had signs of meningeal irritation, and his temperature was 104°F. Laboratory studies established the diagnosis of meningococcic meningitis. He recovered under sulfadiazine and penicillin treatment. When he regained consciousness, he was found to be totally deaf in the left ear and could hear only loud noises in the right. There was spontaneous past pointing with both hands to the right. The gait was broad based and unsteady. There was no spontaneous nystagmus.

Opticomotor Tests. Prompt nystagmus was obtained on confrontation when the striped drum was revolved in the vertical or horizontal planes. All responses were normal.

Caloric Tests. Irrigation of both ears for three minutes with ice-cold water yielded no nystagmus, past pointing, nor vertigo. On one occasion, upon douching of left ear (for stimulation of vertical canals only), a fine transient nystagmus was noted when the eyes were in the extreme right lateral position. This nystagmus varied in intensity from one minute to another.

Bárány Tests. Rotation in clockwise or counterclockwise directions with stimulation of horizontal and vertical canals failed to elicit ocular responses or vertigo. There was absolutely no nystagmus or past pointing. All of these tests showed absence of labyrinthine functions.

Pharmacologic Tests. Sodium amytal (0.5 gm.) was administered intravenously within six minutes. After 0.2 gm. had been injected, the opticomotor nystagmus decreased, and after the administration of 0.3 gm. of the drug, this type of nystagmus could not be demonstrated.

In other words, the opticomotor nystagmus was abolished.* Two minutes after the initial administration of the amytal was made, a coarse nystagmus appeared when the patient turned his eyes to the extreme lateral upward or downward positions. The nystagmus was more apparent to left than to right and more on downward than on upward gaze. However, the nystagmus was found to fluctuate in its amplitude and rate with change in direction of gaze. One minute, the nystagmus was more marked on left lateral gaze; the next minute, it was more apparent on right lateral deviation.

The patient was observed for two hours. During this period, an alternation in the degree of nystagmus was noted, especially when the patient attempted to maintain his gaze in a lateral position. The same was noted when he tried to keep his eyes either in an upward or downward position. When the nystagmus was found to be pronounced in one direction, it was found to be less marked when the eyes were turned in the opposite direction. This periodicity in amplitude and degree of nystagmus was a frequent finding, even in the normal individual.

Comment. In both of these cases (1 and 2), there was evidence of loss of function in the peripheral vestibular apparatus. Meningitis affected both vestibular nerves. Despite the absence of labyrinthine functions, intravenous administration of barbiturate produced nystagmus just as in the normal individual. From these observations, it would appear that the nystagmus produced by barbiturate is not due to irritation of the peripheral portions of the vestibular organ. The effect seems to be central.

* Since the observations on the ocular movements were made with the unaided eye it is not certain whether the opticomotor nystagmus was completely abolished. Small nystagmoid-ocular excursions might have been present during fixation of the rotating drum.

III. PATIENTS WITH LESIONS IN THE BRAIN STEM.

Case 3. J. F., a middle-aged veteran of the first World War, was admitted to the hospital on July 26, 1944, with a history of sudden onset of dizziness, staggering gait, nausea, and vomiting of three weeks' duration. Examination revealed the blood pressure to be 150/100. There was nystagmus on deviation of eyes to the left and paralysis of conjugate gaze upon shifting them to the right. There was also right peripheral facial weakness. The gait was unsteady.

Opticomotor Tests (performed on August 15, 1944). Counterclockwise rotation of the striped drum with its axis in the vertical plane produced slight and slow deviation of the eyes to the right but not much beyond the vertical meridian. There was no nystagmus. In other words, the expected recovery or quick component to the left was not present. Clockwise rotation of the drum elicited prompt nystagmus (with slow deviation of the eyes to the left and pronounced quick component of the nystagmus to the right).

Bárány Tests. Clockwise rotation of the chair immediately produced chin and eye deviation to the left. On cessation of 10 turns (made within 15 seconds), the patient fell to the right. There was marked increase in the nystagmus on left-lateral gaze. This was most apparent in the left eye. Vertigo was present. Counterclockwise rotation of the chair produced no chin nor eye deviation. On cessation of 19 turns, the patient was dizzy, the eyes were deviated to the left, and he was unable to move his eyes toward the midline to the right. There was absolutely no nystagmus, falling, nor past pointing.

Caloric Tests (performed on August 22, 1944). Irrigation of the right ear

with ice water for 20 seconds produced vertigo, past pointing, falling reactions to the right, and an increase in the nystagmus when the patient turned his eyes to the left. Irrigation of the left ear for 180 seconds abolished the spontaneous, preëxisting nystagmus to the left, and yielded slight vertigo, some pallor, and slight past pointing to the right. There was no nystagmus except for minimal jerks with a quick component to the right.

Pharmacologic Tests (performed on August 15, 1944). Sodium amytal (0.3 gm.) was injected intravenously over a period of five minutes. Slight, slow, coarse nystagmus in all directions of gaze was noted after the first two minutes of injection. The nystagmus was most pronounced on left-lateral gaze and was minimal on attempted right-lateral gaze. An additional 0.1 gm. was administered (total 0.4 gm.) and, four minutes later, ocular deviation to the right could be accomplished but not maintained. Although the globes were turned to the right of the vertical meridian, slow movements of the eyes were noted. The movements were to the left (toward the mid position), and it became apparent that the patient was unable to maintain his gaze to the right. On lateral gaze, the nystagmus was rapid and fine, especially marked in the left eye. These ocular phenomena were present for the next 15 minutes of the study.

As in previous cases, opticomotor nystagmus was abolished. Soon after the injection of 0.1 gm. of the drug, the patient declared that his vision was better. He claimed that it was no longer blurred and that the dizziness had disappeared.

Comment. Clinically, this case showed signs characteristic of a lesion in the pons at the level of the facial nucleus. In this patient, barbiturate definitely altered

the ocular movements. Thus conjugate gaze which was prolonged to the right before the injection became apparent after the injection of the drug. The re-appearance of eye movement to the right was associated with a nystagmus to the right. The nystagmus to the left became much more pronounced and more rapid.

Case 4. R. B. F., a young Marine Corps aviator, was admitted to the hospital on August 16, 1944, with a history of acute onset of extreme dizziness, nausea, and vomiting of five days' duration. Examination was negative except for the ocular findings. On direct forward fixation there was fine nystagmus with a quick component to the left. The nystagmus became more conspicuous as the eyes were deviated to the left. Nystagmus was also present on upward and less marked on downward gaze. There was no nystagmus on gaze to the right. The patient complained of marked dizziness when he turned his head and eyes to the left.

Opticomotor Tests (performed on August 19, 1944). Clockwise rotation of the drum with its axis in the vertical plane failed to elicit nystagmus on repeated tests. Counterclockwise rotation of the drum in the vertical position consistently produced prompt nystagmus with a slow component to the right (in the direction of rotation) and a quick (recovery component to the left.* Clockwise or counterclockwise rotation of the drum with its axis in the horizontal plane produced no nystagmus.

Bárány Tests (performed on August 24, 1944). Clockwise rotation of the patient sitting in the Bárány chair produced marked exaggeration of the nystagmus

to the left with vertigo and past pointing. Counterclockwise rotation (8 turns within 10 sec.) yielded a lesser, fine, and more rapid type of nystagmus to the right and only slight past-pointing reaction.

Pharmacologic Tests (performed August 19, 1944). Five-tenths gram of sodium amytal was administered by vein within four minutes. The patient became markedly somnolent and required frequent rousings in order to carry out the study. Nystagmus became evident on gaze to the right and markedly lessened on gaze to the left. Eleven minutes after the final dose was injected, nystagmus was abolished in all directions of gaze and remained absent for two hours during which the tests were performed. Opticomotor nystagmus was similarly abolished and returned three hours after the drug was injected. As the effect of the drug diminished the nystagmus on lateral gaze reappeared. Diplopia on forward fixation at about one meter's distance occurred as an early effect and persisted for about 45 minutes.

Comment. Although there is no conclusive proof that the lesion in this case was in the brain stem, the persistence of the nystagmus on left-lateral gaze for several days and the presence of nystagmus in the vertical plane suggested that the pathologic lesion was central, probably in the brain stem.⁶ Furthermore, the fact that the nystagmus induced by the opticomotor drum was reversed or found to be present only in the direction opposite to that elicited on examination is, according to Brunner,⁷ a sign that the pathologic nystagmus is central and non-labyrinthine. The latter conclusions were confirmed by Scala and Spiegel⁸ in experiments with cats. In this case, barbiturate markedly decreased the pathologic nystagmus (which was present on at-

* These were performed three days after admission, at which time the patient's symptoms had somewhat subsided.

tempted left-lateral gaze) and produced a nystagmus on right-lateral gaze.

IV. PATIENTS WITH LESIONS IN THE CEREBRAL HEMISPHERES.

Case 5. G. B., a 22-year-old Marine, was shot in the right temporal region. X-ray studies revealed a metallic fragment situated deep in the right-temporal lobe near the thalamus. The injury to the right side of the brain produced a left hemiplegia, hemisensory syndrome, and hemianopia. Besides these, the patient had difficulty in ocular fixation. Not infrequently, the head and eyes deviated tonically to the left, especially while he was fixating a target. These, of course, were involuntary and noted on repeated occasions during the entire observation period.

Bárány Tests. Turning tests, clockwise and counterclockwise, yielded essentially normal responses as to nystagmus, past pointing, and vertigo. There was no difference between the ocular reactions on right- and left-lateral gaze. There were no defects in conjugate deviation.

Opticomotor Nystagmus. Clockwise rotation of the striped drum with its axis in the vertical plane produced normal opticomotor nystagmus. Counterclockwise rotation in the same plane also yielded nystagmus, but the quick components to the left were diminished. Rotation of the drum with its axis in the horizontal plane resulted in a nystagmus. This was more pronounced when the drum was rotated in an upward than in a downward direction.

Pharmacologic Tests. Slow intravenous injection of 0.5 gm. of sodium amytal produced the usual barbiturate nystagmus; it was found to be present on vertical or horizontal gaze. There was no apparent inequality between the right and left sides. Moreover, there were no dis-

turbances in conjugate gaze to either side. The patient was able to maintain his gaze to the left just as well as to the right. Opticomotor nystagmus was not found with rotations of the striped drum in any direction.

Comment. In a patient, with a lesion in the right cerebral hemisphere, who showed difficulty in ocular fixation, intravenous injection of sodium amytal produced: (a) the usual barbiturate nystagmus, (b) no disturbances in ocular gaze, (c) no difference between the right and left sides, and (d) abolition of opticomotor nystagmus just as in the normal individual. In other patients with disturbances in ocular fixation due to a lesion in the right frontoparieto-occipital regions, intravenous barbiturate failed to reveal changes that were significantly different from those found in the normal.

Thus it appears that barbiturate does not materially influence the ocular defects caused by lesions in the cerebral hemisphere. The responses are the same as in the normal, and this is in contrast to the findings in cases of brain-stem lesions. From the available data thus far cited, it would seem that: (a) nystagmus produced by barbiturate is not due to irritation of semicircular canals, as demonstrated by cases 1 and 2; (b) barbiturate influences ocular responses in patients with lesions of the brain stem, as demonstrated by the reversal of direction of nystagmus, by the abolition of the pathologic unilateral nystagmus, and by the provocation of nystagmus to the normal side; (c) barbiturate has no apparent effect on eye movements in patients with lesions in the cerebral hemisphere; and (d) barbiturate abolishes the opticomotor nystagmus normally elicited with the striped drum. Evidently the action of the drug is manifested either by the production of a nystagmus (apparent when the eyes are held approximately in mid posi-

tion, or by the abolition of nystagmus (with the eyes fixating in the mid position). The latter was also observed in cases of latent nystagmus.*

V. PATIENTS WITH VARIOUS FORMS OF NYSTAGMUS:

A. Latent Nystagmus.

Case 6. A. P. W., an 18-year-old seaman, second class, had been aware of difficulty of vision since the age of six years. He had noted that whenever he closed one eye, objects within his gaze quivered and moved back and forth in a horizontal plane (oscillopsia). This subjective impairment was more marked in the right eye than in the left. There was no such oscillopsia with both eyes open.

Examination revealed a divergent squint and paralysis of convergence. Visual acuity was diminished when each eye was tested separately, in the right eye more than in the left; binocular vision was much better. On covering either eye, a marked nystagmus was noted in the uncovered as well as the covered eye. The same type of nystagmus was obtained by splitting the binocular vision. This was accomplished by holding a cardboard between the two eyes in the sagittal plane. There was no spontaneous nystagmus on binocular fixation in any direction.

Opticomotor Tests. Direct confrontation with the revolving, striped drum in the vertical or horizontal position did not produce nystagmus. However, a slight nystagmus was obtained when the drum was in the vertical position but held a little to the right or left of the midline.

Barány Tests. Marked coarse nystagmus was produced by the usual rotation

of the chair in clockwise and counterclockwise directions. However, there was minimal past pointing and no subjective vertigo.

PHARMACOLOGIC TESTS. Sodium amytal administered intravenously elicited the following results. A total of 0.35 gm. of the drug was delivered in divided doses in three minutes. At the end of this period, nystagmus was observed on right- and left-lateral gaze. The latent nystagmus previously found on uniocular fixation was no longer present and remained absent for the next 25 minutes. Visual acuity on uniocular fixation was much improved. Opticomotor nystagmus could not be obtained with eyes held in mid position.

The patient was observed for 90 minutes. During this period, it was found that the nystagmus, on horizontal gaze, presumably induced by the drug, varied in speed and amplitude from side to side. At one moment, it was more pronounced to the right, at another to the left side, with reversal occurring approximately at one-minute intervals. It was also noted that, as recovery from the barbiturate became generally manifest, the latent nystagmus reappeared.

Comment. The barbiturate in this patient abolished a nystagmus (latent nystagmus). Observation in 12 other cases of so-called congenital nystagmus revealed the same results in all but two. The abolition of nystagmus was invariably accompanied by a subjective and objective improvement in visual acuity. Such improvement has been noted in many patients with such nystagmus and one of these cases was described in detail elsewhere.⁸

B. Voluntary Nystagmus.

Case 7. A. R. G., a Marine, aged 25 years, was admitted to the hospital for investigation of recurrent attacks of un-

* Latent nystagmus can be demonstrated by covering one eye or by splitting binocular vision by holding a piece of paper close to the bridge of the nose in the sagittal plane. The nystagmus elicited only with monocular vision is apparent even when the eyes are in the mid position.

consciousness with accompanying paralysis of the right arm and leg. These were ultimately found to be psychogenic. Physical examination was remarkable only in the presence of fine, rapid, horizontal nystagmus to either side, which the patient claimed was voluntary. He was able to demonstrate the nystagmus quite at will. The nystagmus was more of a tremor of the eyes, rather than the to-and-fro lateral movements. There were no quick and slow components. He stated that he had been aware of a spontaneous "shaking" of his eyes, six years before he entered the service. He also claimed that, during his production of the nystagmus, objects widened in the horizontal but not in the vertical plane. Apparently he learned to bring this about by his own volition and to stop it in the same fashion.

Opticomotor tests were not performed.

Bárány Tests. Clockwise rotation of the chair yielded nystagmus to the left; counterclockwise turning yielded nystagmus to the right. The responses were slight and of brief (3- to 5-sec.) duration. There was minimal vertigo and past pointing. Vigorous and prolonged turning did not exaggerate the results. Interestingly enough, the patient was able to alter this induced nystagmus at will. It was manifested by an increase in the degree of eye movements (nystagmus) elicited by the turning chair. He could superimpose his voluntary nystagmus upon the nystagmus produced by the Bárány turning tests.

Pharmacologic Tests: Sodium amytal (0.5 gm.) was administered intravenously in about five minutes. At the end of four minutes, slight coarse nystagmus was present in the horizontal gaze. There was little or no nystagmus on upward gaze. The patient was somewhat drowsy for 20 minutes. Voluntary nystagmus was attempted but failed. This time he had no "control of the eyes." Strong

effort to produce voluntary nystagmus resulted only in an upward rolling of the eyeballs. The inability to produce nystagmus at will lasted 40 minutes. Finger-to-nose tests showed no ataxia. There were no gait disturbances and the station was secure.

Comment. Here is another example of the abolition of a form of nystagmus (voluntary). Although this patient did not have clinically demonstrable signs of a lesion, he did seem to show a decreased or minimal reaction to vestibular stimulation. The most remarkable feature in this case was the voluntary production of nystagmus and its abolition with barbiturate.

C. Postural Nystagmus.

Case 8. R. M. S., a steward's mate, second class, aged 19 years, complained of motion sickness. He had been troubled for as long as he could remember with nausea and vomiting when riding in vehicles. He had never been able to lie flat upon his back without a feeling of marked dizziness, but had always slept with his head supported by a pillow. General examination was negative except for the fact that sudden retraction of the patient's head produced fine and very rapid vertical nystagmus and extreme vertigo.

Opticomotor Tests. Prompt, normal responses were obtained with rotation of the striped drum in any plane.

Bárány Tests. With only three turns of the revolving chair in either direction, severe vertigo and nausea ensued with accompanying rapid, coarse nystagmus, past pointing, and falling reactions of typical type. The nystagmus thus induced lasted well over 15 seconds.

Pharmacologic Tests. Intravenous sodium amytal (approximately 0.4 gm.) was administered within six minutes. Typical barbiturate nystagmus appeared

after 0.1 gm. of the drug had been injected. Opticomotor nystagmus was promptly abolished. The most remarkable effect of the barbiturate was the abolition of nystagmus elicited on retraction of the head. Not only did this nystagmus disappear but the dizziness previously experienced by the patient on this maneuver was also no longer present. When the effect of the drug had worn off, retraction of the head again produced the vertical nystagmus and severe dizziness.

Comment. The cause of the postural nystagmus in this case could not be ascertained. The fact that the nystagmus was manifest only in the vertical plane suggested that the pathologic lesion was in the brain stem.⁵ However, Spiegel and Scala⁹ were able to produce vertical nystagmus by lesions in the labyrinth. Hence, a peripheral origin could not be excluded. Be that as it may, the most significant finding in this case was the abolition of postural nystagmus by intravenous injection of sodium amytal. Thus far it is apparent that barbiturates influence eye movements either by production or by an abolition of nystagmus. With these facts in mind, we studied the effect of barbiturate in a patient who showed impairment of ocular movements, apparently due to hysteria.

VI. PATIENTS WITH OCULAR PALSIES

Case 9. J. D. G., a 41-year-old Marine, was admitted to the hospital complaining of weakness, fatigue, nervousness, difficulty in walking, twitching of both hands, apparent lapses of consciousness, and sudden spells of unexplained rapid heart action with breathlessness and feelings of apprehension.

Examination revealed staring facies and bizarre gait with alternate dragging of lower limbs. There were numerous bizarre types of twitchings and tremors of hand and feet, and peculiar ataxia of

all point-to-point tests. The eye examination showed spasms of convergence and apparent weakness of both external rectus muscles. Lateral eye movements were almost absent. On attempted upward gaze, the eyes rolled upward, exposing the inferior scleras but the upper lids failed to retract. In fact, they partly closed, thus giving a picture similar to Bell's phenomenon. There was no true weakness of the facial muscles. There were inconstant, atypical areas of sensory deficit of hemi-corporal distribution alternating with glove and stocking type of anesthesia. The patient's emotional attitude was one of *belle* indifference. The clinical picture was one of hysteria. This was confirmed, by the history and by subsequent special personality studies.

Pharmacologic Tests: Following intravenous injection of 0.5 gm. of sodium amytal, nystagmus appeared when the patient attempted to direct his eyes away from the mid position. Following the appearance of this nystagmus, his eye movements improved. The apparent weakness of the external recti disappeared. Conjugate eye movements were now good in all directions and associated with barbiturate nystagmus. Upward gaze was prompt and accompanied by normal, concomitant retraction of the superior eyelids. Following this procedure, the patient was able to move his eyes in a normal fashion during the remainder of his hospitalization period.

Comment. Here, again, barbiturate altered eye movements. It is not surprising that sodium amytal abolished hysterical paralysis of ocular muscles—this has been noted by many observers. However, one is not always certain whether the hysterical ocular-muscle palsy is on a conscious or unconscious level. It is possible that the amytal specifically altered ocular function in this case just as it did in the case of voluntary nystagmus. In other words,

the ability to control eye movements was abolished by the amytal. This does not necessarily mean that hysterical ocular paralysis is entirely on a voluntary basis, for we have pointed out that ocular disorders due to organic disease are also influenced by barbiturates. The following case raised the question whether suppression of an ocular movement was on a voluntary or involuntary basis.

Case 10. J. C., a 34-year-old steward's mate second class, was admitted to the hospital for study of an internal squint of the right eye which, he claimed, had occurred about three months before admission.

Preënlisment history disclosed poor school and employment records, repeated arrests for alcoholism, and other signs of defective social adjustment. He had always been impulsive and emotionally unstable. Psychometric tests revealed moron or borderline intelligence level.

Examination was essentially negative except for an internal strabismus of the right eye of about 40°. This strabismus seemed to vary in degree. The patient also claimed he could not turn either of his eyes to the right or left. On several occasions, however, it was reported that the patient's eyes were perfectly straight. This was apparent when he was intoxicated with alcohol. During that period, his eyes were not only straight but moved coördinately in all directions. All eye movements appeared normal at this time. This suggested to some observers that the patient was simulating his ocular disorder.

Bárány Tests. These failed to produce significant nystagmus on clockwise or counterclockwise turning. The absence of nystagmus may have been related to his claim that he could not move his eyes to either side (suppression of eye movements?). The usual vertigo, past-point-

ing, and falling reactions were present. The lack of oculomotor reaction suggested a dysfunction in the vestibular system. However, this was not conclusive. In order to exclude the conscious element or that of malingering (conscious suppression of eye movements), the patient was subjected to special tests.

(1). The patient was stimulated with the electric-shock machine, and a grand-mal seizure was produced. During and immediately following the convulsion, the internal squint disappeared and conjugate eye movements were found to be present. Five minutes after the convulsion, the strabismus returned, also the impairment of horizontal eye movements. At this time and during the next 35 minutes, the patient was amnesic, confused, and totally disoriented. It was assumed that, during this altered mental state, the patient was not conscious of intent to deceive. It is doubtful whether he could simulate the strabismus which returned during this period. And (2), petit-mal seizures, also electrically induced, failed to change the squint although the patient was rendered confused and amnesic. Again, the patient's mental state precluded simulation, and these findings confirmed the observations made following grand-mal seizures. The squint was not due to malingering.

Pharmacologic Tests. Slow injection of 0.5 gm. of sodium amytal into the arm vein produced, within a few minutes, a change in the ocular status. The internal squint disappeared, and the eyes appeared to be normal. There was no nystagmus during this period of observation. Conjugate, horizontal eye movements were executed on direct command, on follow fixation, and on fixation with passive turning of the head. There was no difference between right and left side.

While under the influence of the barbiturate, the patient spontaneously volun-

teered that he had been subject to ocular disturbances for a number of years before enlistment. He had double vision, the right eye turned inward, and the lids squinted. These were particularly apparent when he was "nervous" or emotionally tense.

The pharmacologic study was repeated at a later date, when pentothal sodium (0.1 gm.) was given by intravenous injection. Within one minute, the internal strabismus disappeared. There was no nystagmus. A very transient nystagmus on lateral gaze appeared on the administration of an additional 0.1 gm. of the drug. Again the ocular squint disappeared.

Comment. Barbiturate abolished an ocular squint. The same effects were apparently obtained when the patient was intoxicated with alcohol. The fact that the squint persisted during the period of postconvulsive confusion and during the amnesia produced by an electrically induced petit-mal state, would seem to exclude the possibility of malingering or of voluntary ocular deviation with intent to simulate an illness. If the squint were due to hysteria, it must have been on a subconscious basis. The absence of nystagmus during the period of barbiturate intoxication and on Bárány turning tests suggests an organic disorder in the central vestibular system and not a suppression of eye movements. According to Bartels,¹⁰ lesions or disorder of the central vestibular system may produce ocular squint.

It is improbable that the ocular squint was abolished by action of barbiturate on the ocular muscles. In patients with ocular-muscle palsies, intravenous injections of sodium amytal did not alter the paralysis due to a lesion in the abducens nerve nor did it influence ocular movements in a patient with congenital weakness of all the external ocular muscles.

DISCUSSION

From the foregoing observations, it is apparent that the barbiturates influence eye movements which involve a cortical component (voluntary deviation and fixation). Although the available clinical data cannot explain the *modus operandi* of this effect, they suggest that the site of action of this drug is in the cerebral cortex and partly in the brain stem. Analysis of the case material will show that the most conspicuous alterations in eye movements were noted in patients with disease of the brain stem. However, it is realized that the evidence is not altogether conclusive because the drug probably acts at all levels of the nervous system.

According to Goodman,¹¹ barbiturate in small doses produces its effect largely by release "phenomena and consequent overactivity in the nervous system, especially in subcortical and lower regions." Release of cortical inhibitory influences on the central vestibular system might thus explain the patient's inability to maintain gaze in any one direction when under the influence of a barbiturate. The inability to maintain voluntary gaze is manifested largely in the form of nystagmoid movements yielding the clinical picture of barbiturate nystagmus. Since voluntary nystagmus and opticomotor nystagmus each involves a cortical component, the same theory may explain abolition of such nystagmus.

This theory, however, does not account for the abolition of positional or other forms of nystagmus cited in the text. Nor does it entirely explain the transitory disappearance of an ocular squint. An additional hypothesis would be that barbiturate, a well-known brain anesthetic,^{3, 12} also interferes with impulses going to and coming from the vestibular nuclei. Since the latter have a strong influence on the ocular status,¹³

any alteration in the function of these nuclei will be reflected by a change in eye movements.

Whatever the explanation may be, it is clinically significant that barbiturate abolishes various forms of nystagmus and alters eye movements which involve a cortical component.

SUMMARY

1. Intravenous injections of barbiturate (sodium amytal 0.5 gm.) produces in the normal individual: (a) coarse nystagmus and inability to maintain gaze on voluntary deviation of the eyes in any one direction, and (b) abolition of opticomotor nystagmus as elicited by rotation of a striped drum upon which the patient fixates.

2. Intravenous injection of barbiturate also alters or decreases the nystagmus due to disease of the brain stem and abolishes such types of nystagmus as:

(a) latent (nystagmus obtained with monocular fixation or on exposure to darkness), (b) positional (nystagmus obtained on retraction of the head), (c) voluntary (nystagmus obtained by the patient at will), and (d) various forms of so-called congenital nystagmus.

3. Intravenous injection of barbiturate restored eye movements in patients with hysterical ocular palsies and temporarily corrected an ocular squint of unknown origin.

4. It is suggested that barbiturate in mild doses interferes with ability to control eye movements and ocular fixation by its action on the cerebral cortex, brain stem, and intermediate neuronal structures. Eye movements which do not necessarily involve a cortical component might be altered by barbiturate as a result of its action on the brain stem.

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THE PATHOLOGIC CHANGES IN RABBIT EYES RESULTING FROM EXPOSURE TO LIQUID NITROGEN MUSTARDS*

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Two vesicant agents of potential use in chemical warfare have been designated HN_2 (dichlor-diethyl ethylamine) and HN_3 (trichlor-triethylamine), both known as nitrogen mustards. In order to determine the effect of these agents on ocular structures, rabbit eyes were exposed to varying amounts of each until a standard clinical ocular lesion was established for each agent. A series of such standard lesions was produced for each agent, and the following pathologic studies carried out to determine the type of histologic change present.^{1, 2}

The eyes of young chinchilla rabbits were burned on the superior limbus by a standard amount of liquid vesicant agent delivered through a microsyringe.³ The dose of HN_2 was 0.8 mg. in one series, and this dose was reduced to 0.4 mg. in another series in order to produce a milder lesion. The dose of HN_3 was 0.4 mg. in all instances. The HN_2 eyes were enucleated at 1 hour, 6 hours, 12 hours, 24 hours, 2 days, 3 days, 5 days, 8 days, 12 days, and 3 weeks following burning with the vesicant. The HN_3 eyes were similarly removed at intervals of 2½ hours, 6½ hours, 24 hours, 2 days, 4 days, 5 days, 10 days, 14 days, 33 days, and 16 months. The discussion of pathologic changes concerns average eyes studied at each time interval.

All eyes were fixed in formalin for a minimum of 24 hours, following which

they were prepared for histologic section by the celloidin technique. The sections were cut 16 μ . thick and stained with hemotoxylin-eosin. Photographs were taken to show typical changes at the various stages of the lesions. Detailed protocols of each stage were outlined in the original work, but here a general summary of the pathologic changes will be given.

HN_2 EYES

The conjunctiva is the site of edema and congestion, followed progressively by increasing cellular infiltration, loss of epithelium, necrosis, and degeneration, a process which never reverses in the more severe 0.8 mg. lesion. At the end of three weeks, the conjunctiva in the 0.4 mg. lesion remains edematous, thickened, congested, and infiltrated, with inflammatory cells, but has not undergone necrosis. The corneal epithelium shows slight edema of the basal cells as early as one hour (fig. 1) which gradually increases in severity (fig. 2) so that by 12 hours (fig. 4) the cells are beginning to separate from the underlying stroma, and by 24 hours have largely become lost (fig. 6). Complete denudation persists with attempts at regeneration of epithelium beginning around the third day, such efforts being accompanied by edema of the new cells and repeated loss (fig. 11). The regenerative attempts appear even after the eye has perforated. But at three weeks, complete repair has not even occurred in the milder 0.4 mg. lesion, epithelium being found only over about half the corneal section.

Slight edema at one hour is also the first change observed in the corneal

* From the Department of Ophthalmology of the University of Pennsylvania Hospital. The work described in this paper was done under a contract, recommended by the Committee on Medical Research, between the Office of Scientific Research and Development and the University of Pennsylvania.



Fig. 1 (LaMotte and Leopold). Limbal congestion, slight corneal and iris edema, empty anterior chamber, intact epithelium and endothelium. 1 hr.

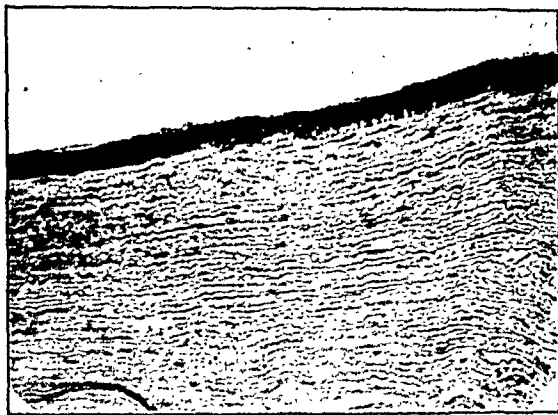


Fig. 2 (LaMotte and Leopold). Edema of basal cells of corneal epithelium. Beginning stromal edema and early cellular pyknosis. 6 hrs.

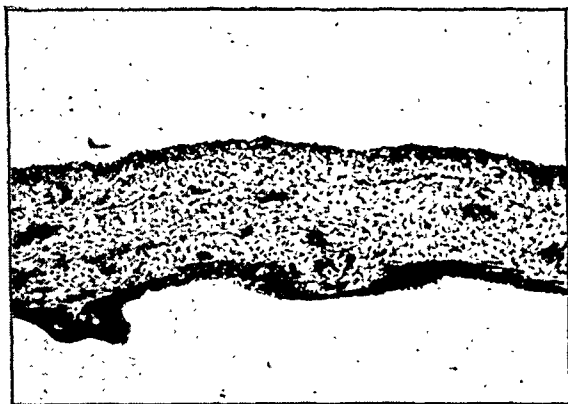


Fig. 3 (LaMotte and Leopold). Edema, congestion, and thickening of iris. 6 hours.

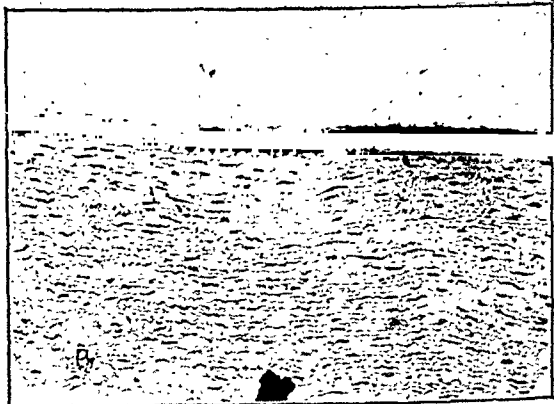


Fig. 4 (LaMotte and Leopold). Continued basal cell edema with beginning separation from stroma. More marked stromal edema. 12 hrs.

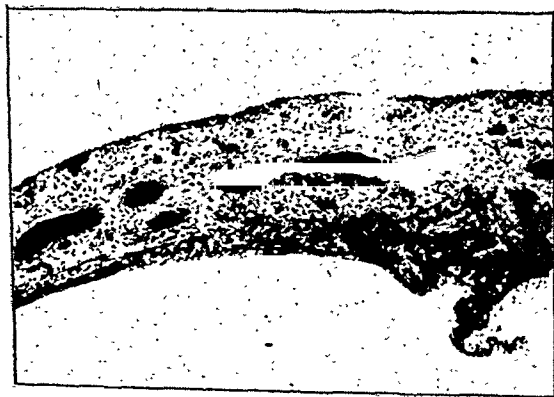


Fig. 5 (LaMotte and Leopold). Increased congestion and thickening of iris. Beginning material in anterior chamber. 12 hrs.



Fig. 6 (LaMotte and Leopold). Loss of corneal epithelium, increase in stromal edema, pyknotic stromal cells, poor staining qualities of stroma. 24 hrs.

stroma (fig. 1). This increases slightly during the first six hours (fig. 2), during which time the stromal cells first begin to show very early pyknotic changes and the corneal fibers give evidence of poor staining properties. Yet the stromal changes remain relatively mild until the period from 12 to 24 hours, when the edema becomes marked enough to increase the corneal thickness and the stromal cell damage is sufficient to result in a decrease in the number present (fig. 6). The stage of infiltration with inflammatory cells begins between 24 and 48 hours; in some cases, the infiltration is marked by 48 hours, in



Fig. 9 (LaMotte and Leopold). Continued congestion and necrosis of iris and ciliary body. Inflammatory cells in and around iris and ciliary processes. 48 hrs.

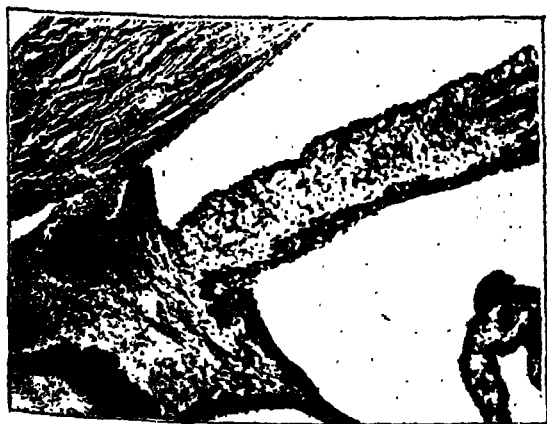


Fig. 7 (LaMotte and Leopold). Continued engorgement and beginning necrosis of iris and ciliary body. Beginning collection of cells in anterior chamber. 24 hrs.



Fig. 8 (LaMotte and Leopold). Corneal epithelium still absent, stromal edema, cellular infiltration already near corneal center, loss of stromal cells, marked exudate in anterior chamber. 48 hrs.



Fig. 10 (LaMotte and Leopold). Section near angle showing marked cellular exudate in anterior chamber, infiltrated cornea, iris, and c.b., with loss of normal detail and structure due to necrosis. 72 hrs.

others it is not well developed until 72 hours or more. Edema continues to increase during this time, and necrosis proceeds rapidly, for by the second or third day most, or all, of the stromal cells are



Fig. 11 (LaMotte and Leopold). Great thickness of cornea due to edema and intense cellular infiltration into posterior layers. Edematous regenerated epithelium. 5 days.



Fig. 12 (LaMotte and Leopold). Further necrosis and increased cellular infiltration of iris. 5 days.

gone and the stromal fibers have become hyalinized and structureless. It is at about the 48-hour stage that small vessels are first seen in the corneal substance near the limbus. In the 0.8 mg. lesion, vascularization beyond this point seems to be inhibited for, although the vessels can be found near the limbus throughout the course of the lesion, they never extend far toward the center of the cornea. In the 0.4 mg. lesion, on the other hand, vascularization is a prominent feature, and by three weeks vessels are still seen in all layers and in some cases, extend almost to the center of the cornea. In the 0.8 mg. lesion, loss of corneal substance through

slough begins as early as 48 hours and increases rapidly so that some eyes perforate by the end of the first week, although most remain intact until the middle of the second week. No successful repair being accomplished, the eyes appear, at the

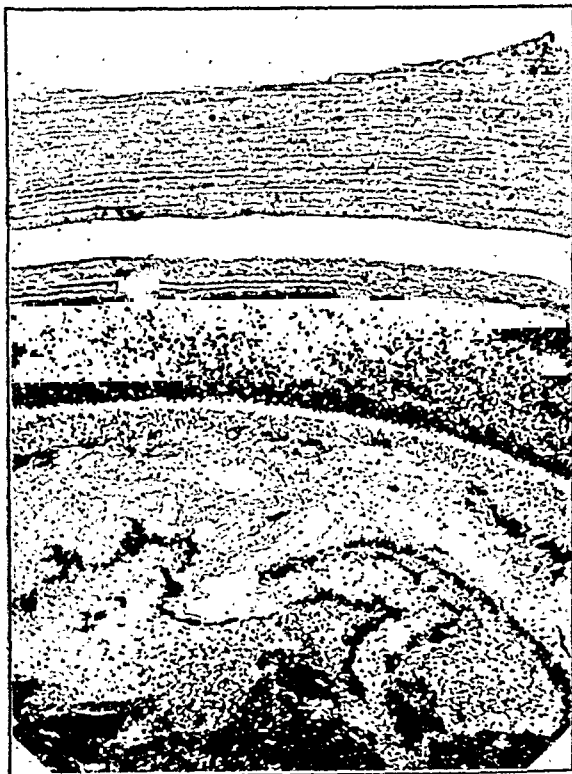


Fig. 13 (LaMotte and Leopold). Corneal slough in eye which has perforated. Necrosis and hyalinization of iris and ciliary processes. 8 days.

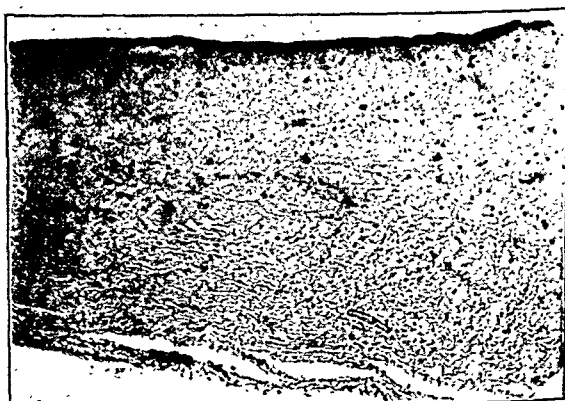


Fig. 14 (LaMotte and Leopold). Intact area of a perforated cornea showing regenerated epithelium overlying necrotic and hyalinized stroma. 12 days.

end of three weeks, as necrotic degenerated masses. After three weeks, the milder lesion presents an intact, but thickened, edematous, infiltrated, and vascularized stroma, with no stromal cells in evidence.

The most striking and most severe changes occur in the iris and ciliary body. By the end of six hours (fig. 3), edema and congestion are much more marked here than in the cornea, and by 12 hours (fig. 5), engorgement has become tremendous. At this time there is already evident slight damage to the endothelial cells of the uveal vessels, and some free hemorrhage into the edematous iris stroma. Likewise, protein material is seen by this time in the anterior chamber.



Fig. 15 (LaMotte and Leopold). Further necrosis of ciliary processes, iris, and cornea. 12 days.

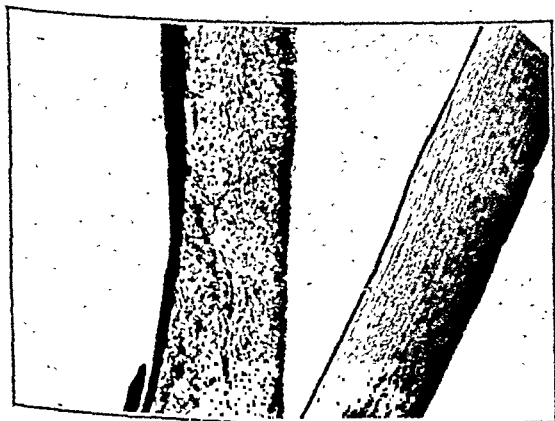


Fig. 16 (LaMotte and Leopold). Iris and cornea. No significant alteration in normal structure. 2½ hrs.

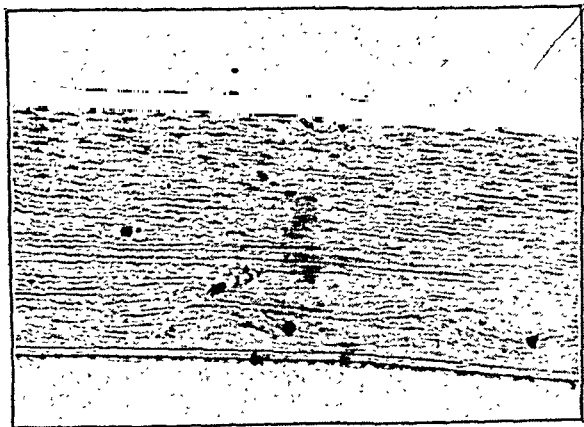


Fig. 17 (LaMotte and Leopold). Cornea. No significant change. 6½ hrs.

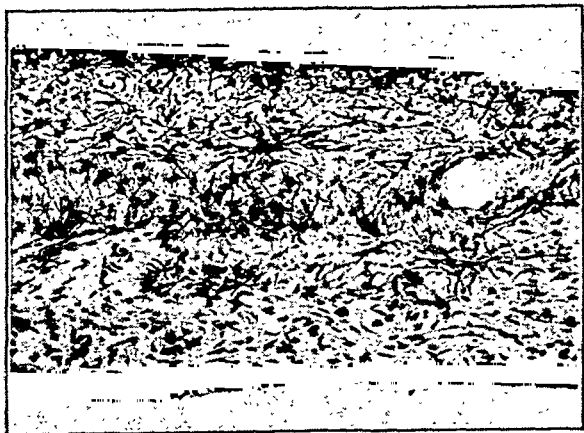


Fig. 18 (LaMotte and Leopold). Iris. No significant alteration from normal. 6½ hrs.

Necrosis of the iris becomes evident between 12 and 24 hours and, by 48 hours (fig. 9), has proceeded rapidly to the point where normal cellular structure is completely lost. The general architecture is barely recognizable because of the advancing hyaline degeneration, and the edematous, necrotic structure shows invasion by polymorphonuclear leukocytes and macrophages. This process continues unabated in the 0.8 mg. lesion so that by the end of three weeks the iris and ciliary body are but a scarcely recognizable part of the necrotic eye. Even in the three-week-old 0.4 mg. lesion, the process has been severe enough so that the anterior uveal structures have become hyalinized, rendered relatively avascular by the de-

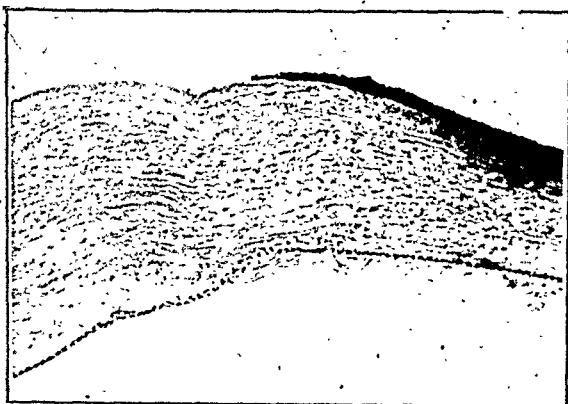


Fig. 19 (LaMotte and Leopold). 24 hrs.

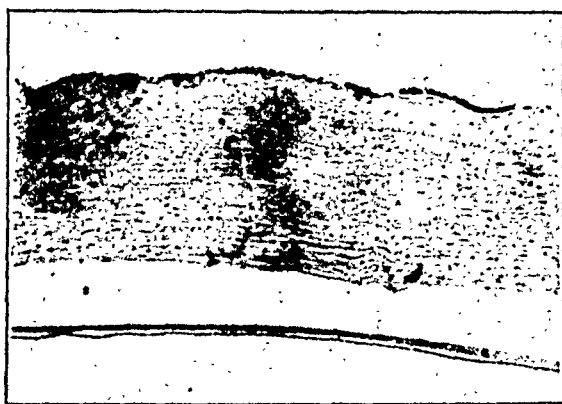


Fig. 20 (LaMotte and Leopold). Demonstrating loss of epithelium edema of stroma, pyknosis of normal cell nuclei, and intact nuclei. 24 hrs.

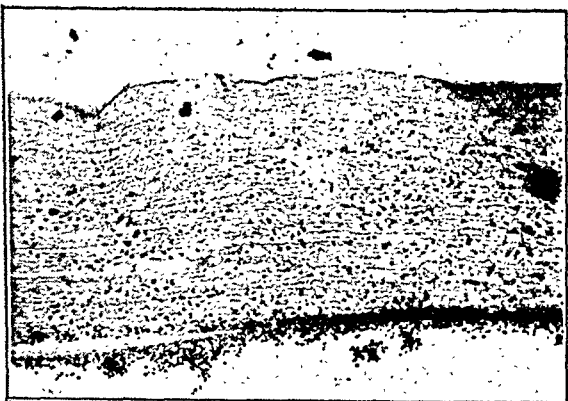


Fig. 21 (LaMotte and Leopold). Loss of epithelium. Breaking of stromal cell nuclei, infiltration of stroma, cells in anterior chamber and on posterior corneal surface, corneal edema. 48 hrs.



Fig. 22 (LaMotte and Leopold). Clumps of inflammatory cells—polymorphonuclears at angle of anterior chamber. 48 hrs.

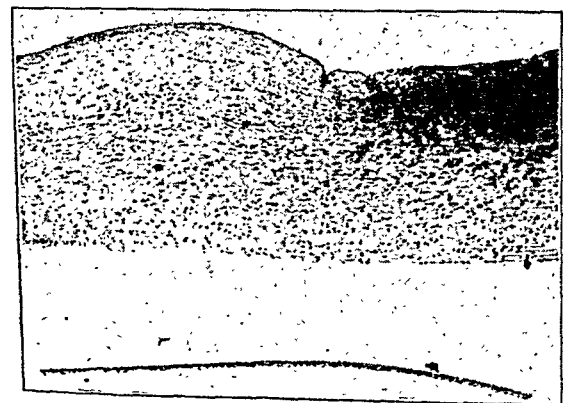


Fig. 23 (LaMotte and Leopold). Corneal inflammatory cell infiltration, corneal edema, necrosis of stromal cells. Intact Descemet's, endothelium showing edema. 96 hrs.

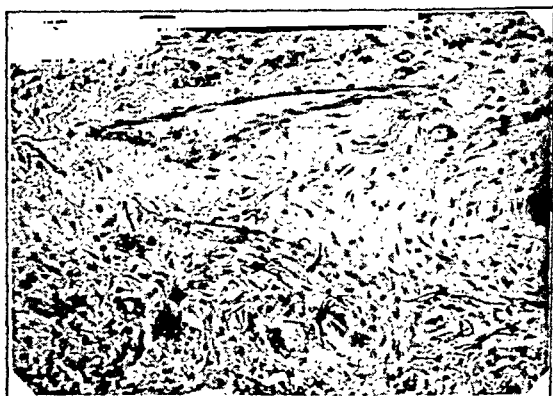


Fig. 24 (LaMotte and Leopold). Iris showing edema. 96 hrs.



Fig. 25 (LaMotte and Leopold). Exudate in anterior chamber, partial loss of endothelium. Continued corneal infiltration—iris slight edema. 5 days.

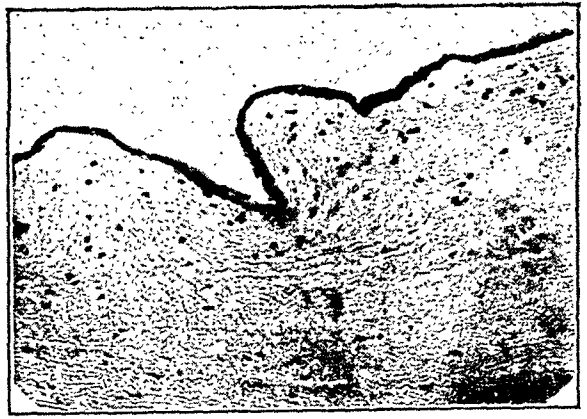


Fig. 26 (LaMotte and Leopold). Showing regenerating corneal epithelium at another site than that demonstrated in figure 25. 5 days.



Fig. 27 (LaMotte and Leopold). Cornea showing vascular and cellular infiltration of stroma, loosely attached regenerating epithelium; intact Descemet's, and endothelium. 10 days.

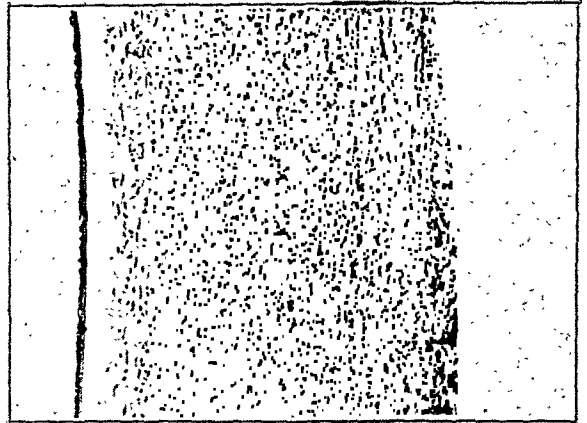


Fig. 28 (LaMotte and Leopold). Another site of cornea seen in figure 27. Diffuse stromal infiltration with dense staining in superficial area. 10 days.

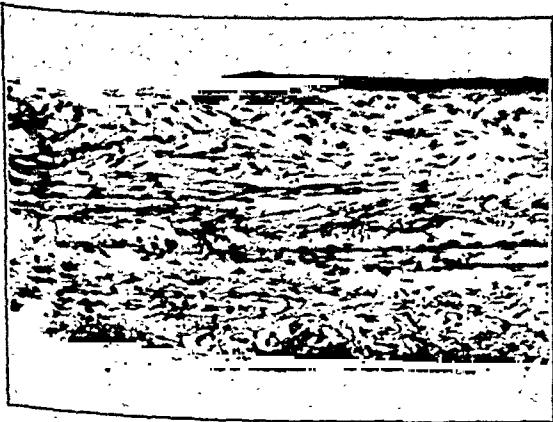


Fig. 29 (LaMotte and Leopold). Iris showing practically no alterations from normal except slight edema; 10 days.

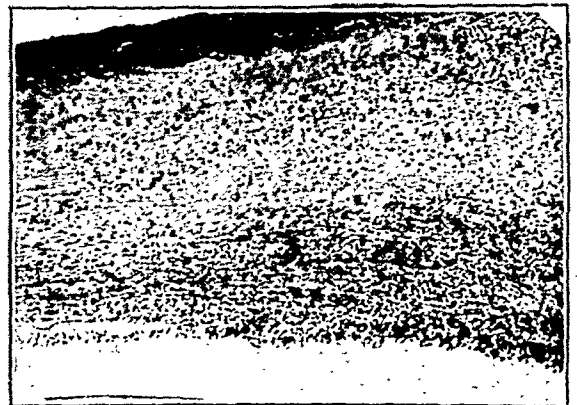


Fig. 30 (LaMotte and Leopold). Superficial slough; diffuse infiltration of inflammatory cells, vessels and fibroblasts; marked thickening of cornea; intact endothelium and Descemet's. 10 days.

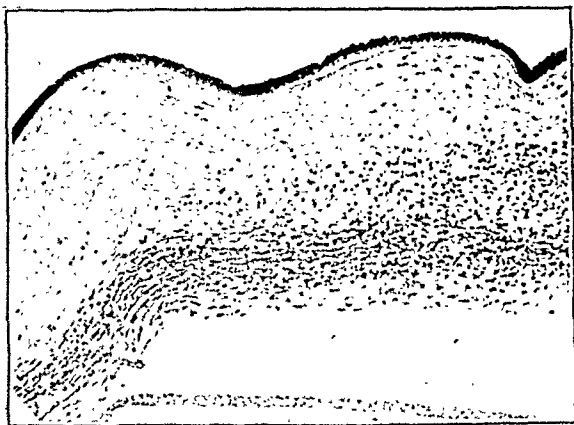


Fig. 31 (LaMotte and Leopold). Same cornea as figure 30—different site. Showing absence of superficial stromal cell nuclei, regenerating epithelium loosely attached, posterior infiltration, intact endothelium. 14 days.

struction of the endothelium of the blood vessels, necrotic and functionally useless in appearance. Yet reparative processes, absent in the 0.8 mg. lesion, are seen in the presence of well-formed fibroblastic bands forming anterior synechiae and occlusio pupillae.

Posterior segment changes are absent except for the expected events in an endophthalmitis accompanying the more advanced and severe stages of the lesions just described.

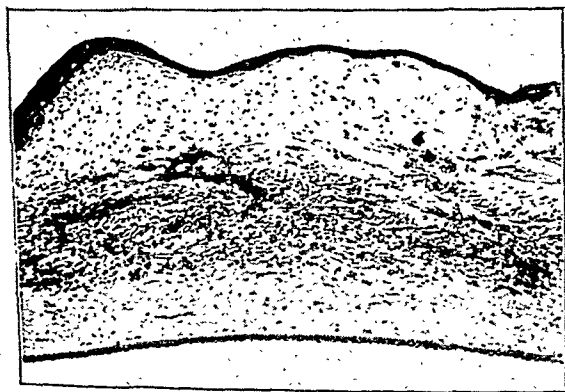


Fig. 32 (LaMotte and Leopold). Regenerating epithelium, edema of superficial stroma, vascularization and cellular infiltration (small round cells and polymorphonuclear cells) chiefly in mid-stromal zone. Intact Descemet's and endothelium. 33 days.

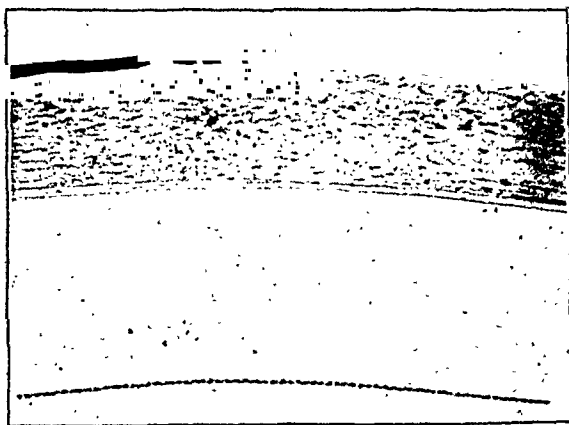


Fig. 33 (LaMotte and Leopold). Intact cornea of normal thickness with no infiltration, vascularization or alteration in normal corneal histology. 16 mos.

HN₃ EYES

The conjunctiva following exposure to HN₃ liquid burns shows, histologically, edema and mild inflammatory cell infiltrations. This change is first noted by 2½ hours after exposure, and the entire process is gone by one month, leaving practically no permanent damage. The limbal region reveals signs of moderate congestion, and inflammatory cell infiltration is also present by 2½ hours, increasing in amount for the first 10 days. The inflammatory cells at first are eosinophilic-staining polymorphonuclear cells, but by the 14th day small round cells are also pres-

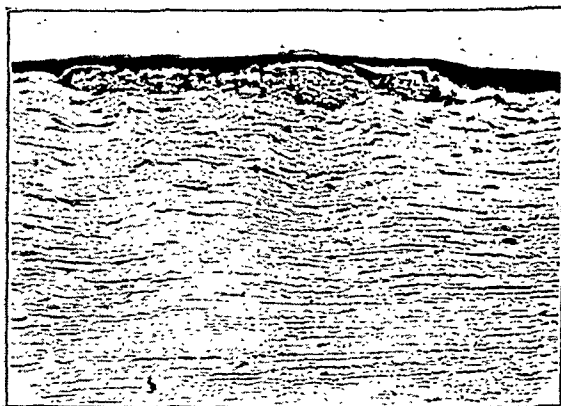


Fig. 34 (LaMotte and Leopold). Same cornea as figure 33 at site of only histologic evidence of damage, showing superficial vessels. 16 mos.

ent. The limbal changes disappear completely after one month.

There is very little evidence of corneal change before 24 hours, at which time areas of epithelium (fig. 19) have been lost, although the basal cells are not at first included. Later, however, complete denudation may occur. Edema of the corneal stroma and death of some of the stromal cells also begin by 24 hours. By 48 hours, these changes have increased, and polymorphonuclear cell infiltration of the stroma has begun. By the fourth day, the greatest degeneration of stromal substance is present superficially (fig. 23). The corneal endothelium remains intact except for local cell swelling until the fifth day, when small areas are lost. At this time, the epithelium has begun to regenerate. Vessels have invaded the stroma by the 10th day, lying chiefly in the mid-stromal zone, although a few are superficially situated. Repair of the stroma by young fibroblasts is also under way by the 10th day, and by the end of two weeks the endothelium is again intact. Vessels and cellular infiltration are still present after one month (fig. 32), and occasional bullae may be found at this time. After about a year, the cornea has largely recovered except for areas of superficial stromal vascularization (fig. 34).

The only change noted in the iris is mild edema starting about two days after exposure. Very little congestion or cellular invasion of the iris ever appear. The anterior chamber shows only a mild exudate around the second day which disappears without sequellae by the 10th day (figs. 18, 24, 29).

DISCUSSION

Liquid HN_2 produces severe ocular damage, an 0.8 mg. lesion resulting in a perforated and lost eye. The milder dose of 0.4 mg. produces severe necrosis of the cornea, but does not prevent reparative

processes from gaining a foothold. Yet at three weeks, the extent of the vascularization appears to be defeating its purpose and instead contributes to the loss of function of this tissue. It is quite evident that HN_3 produces definite corneal changes but, in most instances, the damage is not irreparable. The vascularization here is chiefly of the deep type, and most of these vessels may disappear. The superficial vascularization noted after one year may be related to the bullae previously present. The chief difference between the action of the two vesicant agents is in the changes which they produce in the iris and the ciliary body. Whereas, in HN_3 burns the process never goes beyond the stage of edema, mild congestion, and very slight cellular infiltration, with subsequent complete return to normal histology, the process in HN_2 burns is one of severe necrosis of anterior uveal tissue, degeneration, and loss of function to the extent that any return to normal appears impossible.

The work of Scholz⁴ on the pathology of HN_2 lesions resulted in essentially the same conclusions, although the material studied was obtained from less severe lesions produced, in most instances, by vapor rather than liquid vesicant agents. Maumenee⁵ compared the histopathology of the ocular lesions produced by these two nitrogen mustards and, in addition, a third nitrogen mustard known as HN_1 , together with mustard itself, and concluded that all the lesions were so similar that it was impossible to differentiate one from the other histologically except for the depth of the damage done; the damage to the deeper tissues being greatest with HN_2 , intermediate with HN_3 , and least with HN_1 and mustard.

SUMMARY

1. The histopathologic changes in the rabbit eye due to liquid preparations of the

nitrogen mustards HN_2 and HN_3 are presented and compared.

2. The changes resulting from HN_3 are relatively mild and, in the dosage used, do not preclude recovery.

3. The changes resulting from HN_2 are severe and frequently result in the

complete destruction of the eye.

4. The same major histologic events occur in lesions produced by both of these vesicant agents, the chief difference resting in the degree of damage occurring in the anterior uveal structures.

36th and Spruce Streets (4).

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EFFECT OF OILY DROPS ON EYES EXPOSED TO MUSTARD VAPOR*

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During the recent war, it was frequently stated that oily drops should never be used in an eye which might be exposed to mustard vapor. The reason given was that mustard, being soluble in fat might concentrate in the oily drops resulting in a serious eye burn. That this did not seem probable to us was shown by the fact that, experimentally, a paraffin-liquid mustard droplet caused a milder lesion on a rabbit's cornea than a pure mustard droplet of equal strength. Furthermore, Sollman,¹ in 1919, had shown that certain oily substances, such as linseed oil and cod-liver oil, had a definite prophylactic effect against mustard on the skin.

The following experiments were undertaken to ascertain the truth of the matter and, now that security regulations have been lifted, it was thought advisable to put our conclusions on record.

EXPERIMENTS ON RABBITS METHODS AND RESULTS

EXPERIMENT 1

Two drops of Radiostol (irradiated ergosterol, British Drug Houses), which has a peanut-oil base, were instilled into the right eyes of six rabbits immediately prior to, and at the mid-point of, an exposure to 4 mg./m³ of mustard vapor for 3½ hrs. (Ct† 840). The left eyes were left untreated as normal controls.

* The authors completed this work while attached unassigned as experimental officers in ophthalmology to the Physiology Section (A. Fairley, head), Chemical Defence Experimental Station, Porton, England.

† Ct is a term used in chemical-warfare language to express unit dosage. Ct equals concentration of any gas times period of exposure in minutes.

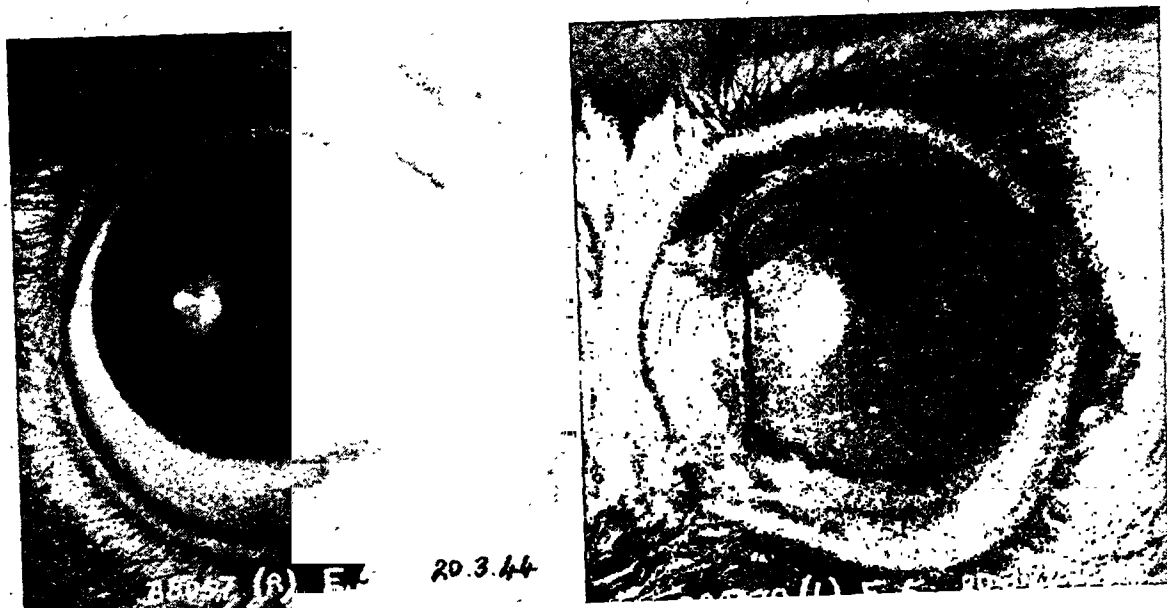


Fig. 1 (Uhde and Dunphy). Both eyes were exposed simultaneously to 4 mg./m^2 of mustard vapor for $3\frac{1}{2}$ hours (Ct 840). Two drops of vitamin D in peanut oil were instilled into the right eye just prior to and at the midpoint of exposure. The left eye was an untreated control. This photograph was made at 72 hours.

The lids of both eyes were sutured open to prevent blinking. The eyes were examined by slitlamp at stated intervals thereafter.

There was a significant difference between the two sets of eyes even as early as 24 hours, the treated eyes showing much less irritation. By the third day, the treated eyes were quite normal; whereas, the untreated control eyes were not only congested, but also showed considerable corneal edema (fig. 1). By the 36th day, the corneas of three of the six untreated control eyes were scarred and vascularized.

EXPERIMENT 2

Under the same conditions as experiment 1, the right eyes of six rabbits were prophylactically treated with vitamin A in peanut oil.

At the end of 24 hours, the treated eyes were better in four rabbits (67 percent), and the same as the control eyes in two rabbits (33 percent). By the 36th day, three of the rabbits were dead, but the corneas of the remaining three un-

treated control eyes, were scarred and vascularized, while only one of the three treated eyes showed any abnormality—a slight nebular scarring.

EXPERIMENT 3

The right eyes of six rabbits were treated as in experiment 1, but with cod-liver oil. The exposure was increased to a dosage of (Ct 1,950).

At observation periods of 24 hours, 9 days, and 19 days, the treated eyes were consistently better than the untreated eyes in four rabbits (67 percent), and equal in two rabbits (33 percent). Two of the untreated eyes developed corneal vascularization by the 19th day.

EXPERIMENT 4

Forty-two rabbits were treated with various oily solutions as shown in the following table, and in the same manner as in experiment 1, but were exposed to an even higher dosage (Ct 2,520). In this case, although all eyes showed damage, the ones treated prophylactically with vitamin D in peanut oil were much less

severely affected than their untreated controls. Olive oil, liquid paraffin, and linseed oil all appeared to afford some measure of protection, also.

EXPERIMENT 5

Since vitamin D in peanut oil appeared to be the most effective of the various oily drops in protecting the cornea, the following experiment was done. The

7,400). The left eyes were untreated.

At 24 hours, 48 hours, and 35 days there was very little, if any, difference between the treated and untreated eyes, all eyes being severely damaged.

EXPERIMENTS ON HUMAN EYES

EXPERIMENT 6

Six volunteers with normal, healthy eyes were exposed to mustard vapor of

TABLE 1
SHOWING THE PROPHYLACTIC VALUE OF OILY DROPS IN PROTECTING RABBIT EYES EXPOSED TO A (Ct) OF 2,520 OF MUSTARD VAPOR

Number of Rabbits	Treatment of Right Eyes	Treatment of Left Eyes	Comparison of Eyes at 24 Hours, 9 Days, and 19 Days after Exposure					
			Treated Eyes Better		Treated Eyes Equal		Treated Eyes Worse	
			No.	Percent	No.	Percent	No.	Percent
6	Vitamin D (peanut oil)	None	6	100				
6	Olive oil	None	4	66	2	33		
6	Liquid Paraffin	None	4	66	2	33		
6	Linseed oil	None	4	66	2	33		
6	Castor oil	None	3	50	3	50		
6	Vitamin A (peanut oil)	None	3	50	3	50		
6	Cod-liver oil	None	2	33	3	50	1	16

right eyes of two rabbits were treated with three drops of Radiostol just before exposure to a very heavy dosage (Ct 7,400). The left eyes were untreated. A specially designed type of respirator was worn to protect the breathing passages, but which left the eyes exposed. Special eye specula were used to prevent blinking.

At 24 and 48 hours there was very little difference between the treated and the untreated eyes. At 35 days the corneas of all eyes were severely scarred and vascularized.

The right eyes of two other rabbits were treated with three drops of Radiostol just after exposure to a dosage (Ct

an approximate dosage (Ct 90). All wore industrial-type respirators which protected the respiratory tract, but left the eyes exposed. Just before entering the gas chamber, each volunteer received two drops of either vitamin A in peanut oil or Radiostol in the right eye only, the left eye remaining as the control. All the volunteers eventually developed a mild chemical ophthalmia in both eyes characterized by conjunctival injection, grayish flecks in the corneal epithelium, photophobia, and lacrimation.

Daily examinations were made. The results are shown in table 2. While these two oils appear to have given slight protection to some of these human eyes ex-

TABLE 2

SHOWING THE PROPHYLACTIC EFFECT OF OILY DROPS IN PROTECTING HUMAN EYES EXPOSED TO (Ct 90) OF MUSTARD VAPOR. RIGHT EYES TREATED WITH TWO DROPS OF EITHER VITAMIN A IN PEANUT OIL OR RADIOSTOL. LEFT EYES UNTREATED CONTROLS

Volunteer	Oil Used	Time Observed in Hours	Symptomatology and Signs									
			Grittiness		Photophobia		Lacrimation		Discharge		Injection	
			O.D.	O.S.	O.D.	O.S.	O.D.	O.S.	O.D.	O.S.	O.D.	O.S.
A	Vitamin A oil	18	0	+	0	0	(+)	0	0	0	(+)	+
		42	0	+	0	0	0	0	0	0	0	(+)
		66	0	0	0	0	0	0	0	0	0	(+)
		90	0	0	0	0	0	0	0	0	0	(+)
B	"	18	0	+	0	+	(+)	0	0	0	0	+
		42	+	0	0	0	0	0	0	0	0	(+)
		66	0	0	0	0	0	0	0	0	0	(+)
		90	0	0	0	0	0	0	0	0	0	0
C	"	18	+	+	(+)	(+)	0	0	0	0	+	+
		42	0	(+)	(+)	(+)	0	0	0	0	(+)	(+)
		66	0	0	0	0	0	0	0	0	+	+
		90	0	0	0	0	0	0	0	0	0	(+)
D	Radiostol	18	0	+	0	+	0	0	0	0	+	+
		42	0	(+)	0	0	0	0	0	0	+	+
		66	0	(+)	0	0	0	0	0	0	+	+
		90	0	0	0	0	0	0	0	0	0	(+)
E	"	18	+	+	(+)	(+)	0	0	0	0	+	+
		42	0	(+)	(+)	(+)	(+)	0	0	0	+	+
		66	0	0	0	0	0	0	0	0	+	+
		90	0	0	0	0	0	0	0	0	+	+
F	"	18	0	0	(+)	(+)	+	+	+	+	+	+
		42	0	(+)	0	0	0	0	+	+	+	+
		66	0	0	0	0	0	0	0	0	+	+
		90	0	0	0	0	0	0	0	0	+	+

(+) Practically normal
 + Mild
 ++ Moderate
 +++ Severe

TABLE 3

SHOWING THE THERAPEUTIC EFFECT OF OILY DROPS AFTER EXPOSING HUMAN EYES TO (Ct 90) OF MUSTARD VAPOR. RIGHT EYES TREATED WITH EITHER TWO DROPS OF VITAMIN A IN PEANUT OIL OR RADIOSTOL THREE TIMES DAILY FOR FOUR DAYS AFTER EXPOSURE. LEFT EYES UNTREATED CONTROLS

Volunteer	Oil Used	Time Observed in Hours	Symptomatology and Signs											
			Grittiness		Photophobia		Tearing		Discharge		Injection		Flecks	
			O.D.	O.S.	O.D.	O.S.	O.D.	O.S.	O.D.	O.S.	O.D.	O.S.	O.D.	O.S.
G	Vitamin A oil	18	+	(+)	+	+	+	+	0	0	+	+	+	+
		42	(+)	0	+	+	+	+	0	0	+	+	+	+
		66	0	0	0	0	0	0	0	0	(+)	+	+	+
		90	0	0	0	0	0	0	0	0	0	+	+	0
H	"	18	+	+	+	+	+	+	0	0	+	+	+	+
		42	+	(+)	+	(+)	(+)	(+)	+	+	+	+	+	+
		66	(+)	0	(+)	0	0	0	0	0	0	+	+	0
		90	0	0	0	0	0	0	0	0	0	+	+	0
I	"	18	0	(+)	+	(+)	(+)	(+)	0	0	+	(+)	(+)	+
		42	(+)	0	(+)	0	0	0	0	0	(+)	+	+	+
		66	(+)	0	(+)	0	0	0	0	0	(+)	+	+	+
		90	0	0	0	0	0	0	0	0	0	+	+	0
J	Radiostol	18	+	(+)	+	(+)	+	+	0	0	+	+	+	+
		42	+	+	+	+	+	+	0	0	+	+	+	+
		66	(+)	0	(+)	0	0	0	0	0	+	+	+	+
		90	0	0	0	0	0	0	0	0	0	+	+	0
K	"	18	+	+	+	+	+	+	0	0	+	+	+	+
		42	+	+	+	+	+	+	0	0	+	+	+	+
		66	+	(+)	+	+	+	+	0	0	+	+	+	+
		90	(+)	0	+	+	+	+	0	0	+	+	+	+
L	"	18	+	+	+	+	+	+	0	0	+	+	+	+
		42	+	(+)	+	(+)	(+)	(+)	0	0	+	+	+	+
		66	(+)	0	(+)	0	0	0	0	0	+	+	+	+
		90	0	0	0	0	0	0	0	0	+	+	+	0

(+) Practically normal

+

++ Mild

+++ Moderate

++++ Severe

+++++ Very severe

posed to a dosage (Ct 90), the results cannot be called significant as was the case in the rabbits exposed to a dosage (Ct 840). However, it is certain they did not have a deleterious effect, as frequently predicted.

EXPERIMENT 7

Under the same conditions as those of experiment 6, another group of six volunteers was exposed to an approximate dosage (Ct 90). However, prophylactic treatment was not given this group, but instead, upon emerging from the gas chamber, each man had two drops of either vitamin A in peanut oil or Radiostol instilled into the right eye, the left eye remaining untreated as the control. The right eyes were treated with these oils three times daily for the next four days. The treated and untreated eyes were compared at various intervals to see if any difference could be noted. All the men developed mild chemical ophthalmia as in experiment 6.

Results are shown in table 3. There were no essential differences between the treated and untreated eyes.

CONCLUSIONS

One eye of each of 64 rabbits was treated with various oily drops just prior to and during exposure to mustard vapor, dosages (Ct) varying between 840 and 7,400. The opposite eye was untreated and

used as a control. It was found that the lesions of the treated eyes were less severe in 40 rabbits (62.5 percent), equal in 23 rabbits (36 percent), and more severe in one rabbit (1.5 percent). When the dosage (Ct) was 840, complete protection in the treated eyes was obtained with Radiostol (peanut-oil base). Even with dosages (Ct) as high as 2,520 most of the oily drops used appeared to give a certain degree of protection to the cornea. When the dosage (Ct) was very high (7,400), there was very little, if any, difference between the treated and the untreated eye, all being severely damaged.

Twelve human volunteers were exposed to mustard vapor, dosage (Ct 90). One eye of each volunteer was treated with oily drops either before or immediately after exposure, the opposite eye serving as a control. Vitamin A, in peanut oil, or Radiostol instilled into six eyes before exposure did not significantly influence the degree of the lesion produced. Vitamin A, in peanut oil, or Radiostol instilled into six eyes three times daily for four days following exposure did not appear to delay normal recovery.

It seems obvious from these experiments that the current belief in the danger of using oily drops in the treatment of eyes exposed to mustard-gas vapor is unfounded.

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SEED GRAFTING OF THE CONJUNCTIVA IN THE TREATMENT OF SYMBLEPHARON

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In November, 1928, the right eye of F. G. was severely damaged by an accident in which molten iron entered the conjunctival sac. Treatment could not prevent severe scarring of the cornea, complete symblepharon of the inferior eyelid, and other cicatrices in the superior cul-de-sac (fig. 1). On February 2, 1929, and on February 1 and April 4, 1930, plastic operations were performed elsewhere, but

by Braun and Wagenstein and developed by J. Staige Davis. The latter "uses a straight intestinal needle held firmly in a straight-nose hemostat and, after the point of the needle is introduced into the epidermis, it is raised, producing a small cone of skin. The base of the cone is cut through with the down-turned blade of a sharp knife. The grafts are somewhat universally, although erroneously, called



Figs. 1-3 (Hagedoorn). Symblepharon before and after seed grafting of the conjunctiva.

Fig. 1, Symblepharon, previous to the plastic operation beginning February 2, 1929.

Fig. 2, Appearance of the eye 17 days after the operation on April 22, 1941. The palpebral fissure has been reopened the (stents) mold is visible.

Fig. 3, The eye has been fitted with a colored contact glass (March 10, 1942).

the result was poor, and on September 27, 1930, a total blepharorrhaphy was done.

When I saw the patient, he believed the right eye to be blind but complained of the cosmetic aspect of the blepharorrhaphy. The ordinary procedures did not seem advisable, the less since they had proved a failure in this case in the hands of an experienced ophthalmic surgeon.

Thin Ollier Thiersch dermo-epidermic grafts, with their whitish discharge give poor results; and, although I have had good results in some cases, mucous-membrane transplants are by no means ideal (Hughes¹). In studying this case, I came on an interesting technique described by Horsley.²

The pinch graft is a procedure devised

by Braun and Wagenstein and developed by J. Staige Davis. The latter "uses a straight intestinal needle held firmly in a straight-nose hemostat and, after the point of the needle is introduced into the epidermis, it is raised, producing a small cone of skin. The base of the cone is cut through with the down-turned blade of a sharp knife. The grafts are somewhat universally, although erroneously, called pinch grafts, since they are originally cut by pinching a cone of skin with tissue forceps and cutting off the base with scissors. This particular technique should be abandoned since the tissue forceps and the scissors produce too much trauma." Since the name "pinch graft" is in contradiction to the major rule of plastic surgery that a transplant should be handled as delicately as possible, the conjunctival variety of the procedure was called "seed grafting."

OPERATION

The patient was operated on on April 22, 1941. The palpebral fissure was reopened. The inferior part of the cornea was found to be leukomatous and covered by connective tissue, although free from

the eyelids. The superior part was clear; the pupil very narrow with *seclusio pupillae*. The patient proved to have definite perception of light; even the direction from which the light came was recognized. There was, consequently, no indication for enucleation.

The symblepharon of the inferior eyelid with the sclera began at about the region of the limbus corneae and was complete, extending from the outer to the inner canthus. The margin and body of the lid for its entire length were inseparably attached to the scleral wall of the eye.

It proved somewhat difficult to free both structures, and a pigmented area was found on the bulbus at the site of a perforation from a former operation. After the inferior eyelid had become freed of the eyeball, it proved to be of about normal thickness, so that no connective tissue had to be resected. The tissues were divided beyond the region of the inferior cul-de-sac down to the inferior bony margin of the orbit in view of the unavoidable postoperative shrinkage.

The superior cul-de-sac was inaccessible because of some bands of connective tissue separated by crypts. The situation now revealed itself to be far worse than could be inferred from the case history of 1930.

The bands were cut or resected, and a new superior cul-de-sac was made, care being taken not to go too far upward and damage the levator palpebrae muscle. Near the margin of the inferior eyelid, eight sutures were placed through the skin. When artery forceps were fixed to these sutures, they pulled the inferior eyelid downward, disclosing and exposing its bare inner surface. These sutures were also indispensable in inserting the mold at a later stage of the operation. For the same reason three sutures were placed near the margin of the superior eyelid.

Finally, a large canthotomy was performed, and the hemorrhage that followed carefully controlled.

The sutures were relaxed, and a form of dental wax (stents) was molded to fit the newly formed conjunctival sac, now denuded of conjunctiva. The central part of mold was made more concave than the curvature of the cornea so that it could not touch and damage its surface. A small hole in the center, 5 mm. in diameter, made observation of the cornea possible during aftertreatment, as soon as the palpebral fissure was reopened (see later). Care was taken that the mold fitted the cavity as accurately as possible and that the eyelids could be closed over it without any tension. The margins of the mold were made rather thick in anticipation of the considerable postoperative shrinkage of the cavity. Hemorrhage was carefully controlled, and tears were prevented from flooding the receptive area by strips of gauze. Lacrimation was moderate, although, fortunately, not absent. The mold was wrapped in sterile gauze and laid aside.

In the next stage of the operation, artery forceps were fixed to the sutures of the inferior eyelid, pulling it downward by their weight and exposing the inner surface, completely devoid of epithelium. The superior eyelid was fixed in a tarsus-clamp forceps, everted so that the normal, tarsal-conjunctiva donor area was revealed. A fine needle was introduced into this conjunctiva; it was raised, but because of the firm fixation of the conjunctiva to the underlying tarsus, the movement was very limited. Consequently, only a very small cone of conjunctiva was obtained; this was cut with a razor blade. This technique was ideal, but it was much easier to snip the small cone off with iris scissors. These small conjunctival snips were grafted on the inner surface of the inferior eyelid and against the eyeball itself, in its inferior

half. Other conjunctival grafts were snipped from any area where a conjunctival lining was present. All these grafts were carefully transplanted, one by one, directly from donor area to the receiving surface. Gentle pressure was applied by a cataract spatula so as to flatten out the grafts and remove excess blood, or serum, and tear fluid. After the last graft had been placed in position, the wound was allowed to dry for a few minutes. The grafts adhered quite well to the underlying tissue. The mold was now reinserted, care being taken to displace as few of the grafts as possible. The sutures of the superior and inferior eyelids were helpful in inserting the mold and in closing the eyelids over it, leaving the tiny grafts *in situ*. The traumatized surfaces of the margins of the eyelids, caused by the cleavage of the blepharorrhaphy in the first stage of the operation, were sutured again.

Figure 2 was taken 12 days after the operation, after the palpebral fissure was reopened. The mold is clearly visible. It was removed on the fourteenth day. On the temporal side, the result was far better than I had expected. However, at the extreme nasal side, in the region of the canaliculus, where the cul-de-sac was very shallow, the result was not so good. This was due to the fact that we failed to free the bulbus sufficiently at this spot and at the whole nasal side under the caruncula lacrimalis. Consequently, the movements of the eye toward the temporal side were still restricted, whereas they were excellent in all other directions. In the future, sufficient freeing of the bulbus will not be neglected. To do this will require more conjunctival grafting, but there seems to be little objection to taking some grafts from the conjunctiva of the other eye, especially in cases where vision is good

and limitation of ocular movements would cause trouble. This could be attempted in new cases in the granular stage.

Recovery was uneventful. Probably because of the ideal physiologic nature of the grafts, there was very little secretion. Nineteen days after the operation, the patient was able to return to work. In the right eye he had light perception and even accurate projection. He was very glad to know that he could see with this eye and that he would be even better off if an operation were performed (iridectomy). However, binocular vision was under this disadvantage: The image of the normal left eye was disturbed by the blurred, distorted, obliquely placed image superimposed upon it by the right eye; a disturbance which probably would be increased if an iridectomy were performed, causing the image of this eye to become more obtrusive. Moreover, the cosmetic effect was unsatisfactory, since dense scar tissue made the inferior part of the cornea whitish.

For these reasons, the original procedure, determined upon prior to the operation, was carried out, and a colored contact glass was inserted. The results, both subjective and objective, were good (fig. 3). The patient has to be content with the knowledge that, should his left eye be lost by another accident, he would be able to help himself with the right eye, now excluded from use.

SUMMARY

Treatment of a case of total symblepharon of the inferior eyelid is described. By means of small "seed" grafts from the conjunctiva of the same eye, in combination with a (stents) mold and a contact glass, the results are as illustrated in figure 3.

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✓IMPLANTATION INTO TENON'S CAPSULE*

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It is generally accepted by ophthalmologists that, when an eye has been removed, the socket for both physiologic and cosmetic reasons should have some sort of an implant. This concept has been so well established that it requires no documentation. Nor is there any intention to discuss here the respective merits of the various shapes, sizes, and materials used for this purpose. My aim here is to report the method used and the results obtained in making a large series of implants because it is probable that the experiences of ophthalmic surgery in war will be of interest to all ophthalmologists.

In the 22-month period from February 1, 1944, to November 30, 1945, there were 144 implantations into Tenon's capsule at this hospital. Of these, 67 immediately followed enucleation. The other 77 were delayed or secondary implants for sockets from which the eyes had been removed overseas from 3 to 14 months earlier. None were lost.

In the first 27 cases Mule's vitreous spheres were used. Tenon's capsule was closed with a 3-0 chromic purse-string suture, and the conjunctiva was closed with a 4-0 black-silk interrupted stitch. In all subsequent cases, a plastic-ball implant was used exclusively, made of the material that was used by the Army in the manufacture of plastic-eye prostheses, a polymer of methyl methacrylate. In these latter cases also, the crossed mattress suture much as described by Kirby¹ was used to close Tenon's capsule and a running black-silk suture was employed for conjunctival closure. In the vast majority of cases, the 16 mm. ball was used. This is an unpolished, solid plastic ball

with small round indentations as illustrated (fig. 1). In only seven cases was either an 18 mm. or 14 mm. implant used. The weight of the ball is approximately

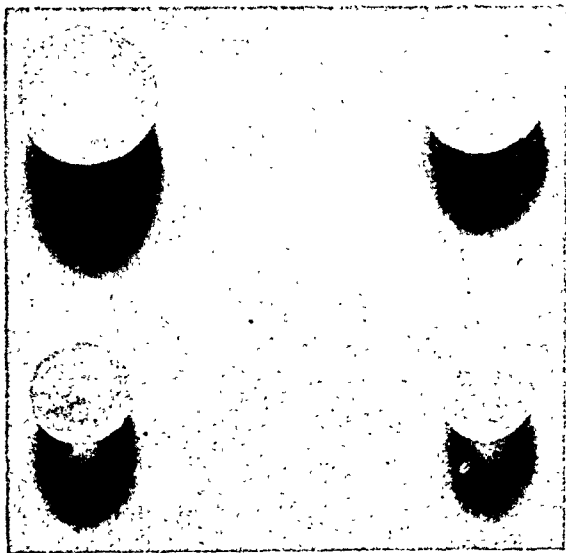


Fig. 1 (Fox). Plastic balls used for implantation into Tenon's capsule. The sizes are 18, 16, 14, and 12 mm.

three times that of the homologous glass sphere. No untoward reactions to the plastic material were noted. Some of these cases were under observation for 12 months or longer.

TECHNIQUE

Enucleations. The patient is given 1.5 gr. of nembutal the night before operation. In the morning 4.5 gr. of sodium amytal is given one hour preoperatively. Just before the patient is wheeled into the operating room, morphine sulphate (0.25 gr.) together with 1 c.c. of prostigmine methylsulphate (1:2,000) is administered intravenously. As shown by Slaughter,² prostigmine has been found to enhance the action of the morphine. Locally the eye is anesthetized by a 0.5-per cent instillation of pontocaine and a retro-

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bulbar injection of 4 c.c. of 1-percent novocaine with adrenalin. More may be given if necessary. The latter anesthetic is also used to balloon up the conjunctiva. This combination has worked so well that general anesthesia has been found unnecessary.

The conjunctiva is circumcised close to the limbus and undermined into the

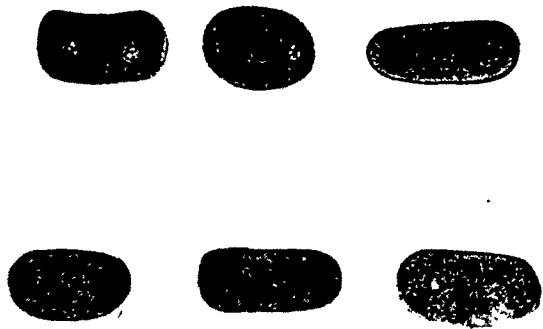


Fig. 2 (Fox). Type of conformers placed into conjunctival sac postoperatively. At first two holes were drilled in them for drainage. This was discontinued when it was found that the conjunctiva tended to protrude through these openings.

fornices and canthi. The four rectus muscles are isolated on a muscle hook and cut close to the sclera at their insertions with a minimum of surgery and without freeing their fascial attachments. An exception to this is made in the case of the external rectus, a 4 mm. stump of which is left attached to the sclera and clamped in a small hemostat to facilitate subsequent handling of the globe. The blepharostat is then placed under the conjunctiva, and the globe proptosed. At this time, the oblique muscles are identified and cut close to the sclera, and all other adhesions to the sclera cut as far back as can be reached. The wire loop of a tonsil snare is then passed over the globe, tightened, and pressed downward. At the same time, an assistant pulls the globe upward by making traction on the hemostat attached to the stump of the external rectus muscle, and the eye is cleanly enucleated.

Hemostasis is obtained by a gauze strip folded into Tenon's capsule and by digital pressure.

The edge of Tenon's capsule is then grasped by four mosquito clamps opposite the insertions of the rectus muscles. Two double-armed mattress sutures of 3-0 chromic catgut are passed through the edge of Tenon's capsule from below upward diagonally as follows:

From the angle between the external and inferior recti to the angle between the internal and superior recti. And from the angle between the internal and inferior recti to the angle between the external and superior recti. A 16 mm. plastic ball is then inserted into Tenon's capsule by means of an introducer, and the sutures firmly tied. The conjunctiva is closed in the horizontal meridian by a 4-0 black-silk running suture knotted at both ends. A slightly curved plastic conformer (fig. 2) with the concavity inward is inserted, and a monocular pressure bandage applied.

The patient is kept in bed for 24 hours. The bandage is removed on the fifth postoperative day, the socket cleansed, the conformer reinserted, and a simple patch reapplied daily for two or three more days. A conformer is worn in the socket until a permanent prosthesis is obtained three or four weeks later.

Secondary orbital implants. Preoperative preparation and anesthesia is exactly the same as for enucleation. Due to the large amounts of fibrous tissue sometimes encountered in traumatic cases, more retrobulbar anesthesia is often necessary. The conjunctiva is opened horizontally in midline and undermined. After identification, a similar opening is made into Tenon's capsule and enlarged with scissors until good exposure is obtained. A large Kelly clamp is then inserted and opened gently so that Tenon's capsule is stretched sufficiently to assure adequate

space for the implant. This is important. From here on, the technique is the same as described above for enucleations.

DISCUSSION

So many implants into Tenon's capsule without extrusion are hard to attribute to any one factor. There is nothing particularly new in any single step of the above outlined technique. As a matter of fact, due to the pressure of work the simplest and shortest procedures were adopted early as time savers. Thus the purse-string was discarded for the simpler, crossed mattress suture for closing Tenon's capsule; the interrupted suture for closing the conjunctiva was abandoned in favor of the simpler running suture. Parenthetically, it might be stated here that motility of the stump—or the lack of it—did not seem to be influenced by the type of closure used. In the case of enucleations, the use of the snare instead of the standard enucleation scissors is, I believe, an important factor. The advantage of using the snare is that it crushes the optic nerve and its vessels instead of cutting them cleanly and thus facilitates hemostasis and obviates secondary hemorrhage. Ophthalmologists who have not used this method of amputating the globe will be agreeably surprised by the minimal amount of bleeding in most cases.

In the case of secondary orbital implants, a factor which cannot be stressed too much is the use of sufficient dissection to give the implant ample room. Another important factor, in both enucleations and secondary implants, is the use of a conformer in the socket in conjunction with a firm pressure dressing which

is undisturbed for five days. As shown in figure 2 this conformer varies in shape from the one first reported by Gifford³ for this purpose. The effect, however, is the same, and my experience fully corroborates Gifford's opinion that postoperative chemosis is reduced by its use.

I do not believe that the kind of implant or sutures used makes much difference in retention of the implant.

CONCLUSIONS

1. In the 144 cases reported I believe that the factors preventing extrusion of the implant from Tenon's capsule after enucleation were: (a) use of the snare instead of the scissors for amputating the globe, (b) use of a conformer together with a firm pressure bandage which is undisturbed for five days. The latter prevents chemosis and assures healing of tissues in proper position.

2. In the case of secondary orbital implants, another factor is important: Sufficient dissection to assure that the implant has ample room in Tenon's capsule and does not have to be forced in.

3. I do not believe that the type or shape of implant used, nor the kind of suture, are of much importance in retention of an implant.

Recent advances in techniques will undoubtedly pave the way for ultimate improvement in type, quality, and mobility of orbital implants and prostheses, especially following immediate enucleation. But for some time to come, and until newer procedures are perfected, the method outlined above will be found adequate and effective.

63 East Seventy-fifth Street (21).

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NOTES, CASES, INSTRUMENTS

ORBITAL CELLULITIS FOLLOWED BY TOTAL BLINDNESS

HUGH C. DONAHUE, M.D.

Boston, Massachusetts

The orbit is the site of various pathologic processes, the most common of which are inflammation and neoplasm in addition to diseases which produce changes in position of the eyeball (exophthalmos and enophthalmos). Trauma, emphysema, extension of infection from the adjacent sinuses and eyelids, blood dyscrasias, and infections of Tenon's capsule may produce orbital change. The literature is replete not only with descriptions of the manner in which all of these disease processes may affect the orbit but also with reports of their results and complications. This report will attempt to describe a sequence of events which resulted in total blindness in an eye, surrounded by massively infected orbital tissues and accompanied by tremendous edema and proptosis, and to record my impression as to why total blindness ensued.

A review of the literature reveals that in many instances blindness or partially reduced vision was the aftereffect of various lesions occurring in the orbit. Complications of neoplasm, trauma, infections, emphysema, exophthalmos, and operative interference during the process of treatment have all been cited as predisposing causes of loss of vision but the actual sequence which led to the visual loss has frequently been concealed behind a cloud of generalities. Thrombophlebitis of the orbital blood vessels and excessive stretching of the orbital portion of the optic nerve due to extrinsic pressure on the nerve from surrounding

pathologic processes have often been terms used to give a vague description of the succession of conditions leading to visual loss.

In the case to be discussed, I was able to observe accurately the sequence of events which I believe produced blindness and the intraocular changes which followed. It would be appropriate, however, first to review some of the causes of orbital cellulitis and the pathologic changes that occur.

This clinical entity is usually unilateral and is most commonly due to infection extending from accessory-nasal-sinus disease or infections of the eyelid extending to the orbital tissue through the blood and lymph vessels. The ethmoid and fronto-ethmoid cells are the most commonly involved sinus areas. Inflammation of the orbit may also result from a thrombophlebitis of the facial vein following infections of the eyelid, eyebrow, lip, and nose. Because of the anastomoses that occur between the veins of the superior maxilla, the mouth, tonsils and pharynx, and the deep orbital veins, extension of infection of these tissues to the orbit may easily result. Metastatic abscess of the orbit frequently arises in infectious diseases such as scarlet fever, chicken pox, and influenza. Tuberculosis of the periosteum may produce orbital cellulitis even in the absence of a break in the skin, and subperiosteal abscess following fracture, injury, or operation may also account for it. The pathologic changes that occur in this disease are inflammatory edema, congestion, stasis, and cellular infiltration with or without suppuration. All of these pathologic conditions occur in orbital phlegmon, orbital thrombophlebitis, subperiosteal abscess, and inflammation in Tenon's capsule.

Orbital cellulitis must be differentiated from cavernous-sinus thrombosis, which is usually bilateral, with marked constitutional symptoms and often accompanied by 3rd-, 4th-, and 6th-nerve paralysis; from serous tenonitis, which is usually bilateral, with severe pain and chemosis but with absence of constitutional symptoms; from panophthalmitis, which always includes involvement of the interior eye; and also from erysipelas, actinomycosis, and other infections.

In the case to be recorded, there occurred a primary infection of a lower lid which resulted in an extremely virulent infection of the intraorbital tissues, producing extreme edema of the lids, chemosis, exophthalmos, and limitation of motion of the eyeball. The patient's vision remained unaffected by all these changes until one morning in the second week of his disease when he noted a distinct and substantial loss of sight while testing his vision. Examination revealed no change in the external appearance of the eyeball from the previous day. There was marked exophthalmos and chemosis. The pupil was widely dilated due to mydriasis. The media were clear. However, the fundus showed the typical picture of embolism of the central retinal artery, with considerable edema of the macula, cherry-red spot, and attenuation of the retinal arteries.

The central artery of the retina, a very slender vessel about 0.25 mm. in diameter, comes off the ophthalmic artery close to the optic foramen and is usually accompanied by another branch. It runs forward, first in or outside the dural sheath of the optic nerve, and then crosses the subarachnoid space with its vein and pierces the optic nerve on its inferior and medial aspect about 10 to 20 mm. behind the eye. Surrounded by an extension of pia mater and a sympathetic nerve plexus, it runs forward and upward from cavernous-sinus thrombosis, which is usually bilateral, with marked constitutional symptoms and often accompanied by 3rd-, 4th-, and 6th-nerve paralysis; from serous tenonitis, which is usually bilateral, with severe pain and chemosis but with absence of constitutional symptoms; from panophthalmitis, which always includes involvement of the interior eye; and also from erysipelas, actinomycosis, and other infections.

During the following days the usual sequelae took place; namely, slow and gradual subsidence of the area of edema and ischemia, with atrophy of the nerve head and constriction of the arteries. In my opinion this is probably the course of events that takes place in the majority of cases of orbital cellulitis which result in either blindness or substantially reduced vision and in which atrophy of the optic-nerve head has been reported.

CASE REPORT

Mr. A. C., aged 48 years, a married, American contractor, was first seen by me in January, 1943. At that time he complained of pain, irritation, and tenderness of the lower lid of the left eye of five days' duration. He had been previously seen by another ophthalmologist, who had treated him during the previous week for an hordeolum of this lid.

Examination proved the right eye to be entirely normal. In the left the vision was 20/20. The upper lid was moderately edematous, the lower lid extremely edematous, with branny induration upon palpation. There was marked tenderness and

sisted for three days. Upon the second morning of such drainage, while the eyeball was considerably proptosed, the patient noted loss of sight. Examination of the fundus was made approximately two hours later and revealed the typical clinical picture of embolism or obstruction of the central retinal artery. There was massive edema of the macular area with ischemia and cherry-red spot; the arteries were constricted, the veins overfilled and tortuous. Vision was reduced to light perception.

It was obvious that the area of massive congestion and edema within the orbit had compressed the retinal artery, producing blockage of blood flow and secondary death of the ganglion cells of the retina. During the ensuing several days the infectious process gradually subsided, but the vision in this eye became nil, and the fundus showed the usual changes that occur following obstruction of the central retinal artery.

Two months following discharge from the hospital the patient's external eye was normal in every respect. There was no edema of the lids or conjunctiva. The eyeball had receded into its normal position, ocular movements were normal, as were also the cornea and iris. The pupil was moderately dilated and reacted sluggishly to light. The media were clear. The disc was snow white and atrophic, the macular area somewhat mottled and degenerated without edema. The arteries were threadlike in size and the veins slightly overfilled and tortuous.

It seems apparent that the loss of vision in this case (and probably in the majority of cases in which impairment of vision follows a condition that produces extreme congestion and edema within the orbit together with proptosis of the eyeball) was due to obstruction of the blood flow through the retinal artery brought about

redness over the entire lower lid; and the ciliary in the lower area, were moderately congested. The cornea, pupil, iris, lens, vitreous, and fundus were normal. The intraocular pressure was normal, as were also the muscular excursions. A diagnosis of cellulitis of the lid was made, and immediate hospitalization advised.

The patient was admitted to the Massachusetts Eye and Ear Infirmary, where he was treated for two days with local applications of heat, and with various forms of local antiseptics together with local and systemic doses of sulfadiazine. During this period, penicillin was available in this hospital only to patients running a septic type of temperature. Upon the third hospital day, the edema of the lids increased, the chemosis of the bulbar conjunctiva was more severe, and there also was present a moderate degree of proptosis. Consultants in otolaryngology and infection were called, and it was deemed advisable to treat this patient with penicillin, even though the supply of this drug was being meticulously distributed. Incision through the upper lid into the superior orbit was also made upon two occasions, and small amounts of purulent material evacuated. Upon the fourth hospital day, the patient was running a septic type of chart. Intramuscular and intravenous injections of penicillin were commenced.

At this stage of the disease exophthalmos measured 7 mm. There was limitation of motion of the eyeball in all directions and marked edema and congestion of the lids and conjunctiva. The fundus was entirely normal other than a slight amount of venous congestion; vision was 20/20. Upon the third day of penicillin therapy the septic material which had accumulated in the orbit became purulent, and there was profuse drainage of pus through the upper lid. This condition per-

DISCUSSION

Before evaluating the indications for prisms in this case, it is well to consider the advisability of prescribing bifocals that contain prisms in their segments. It is usually better to avoid such a type of bifocals for four reasons: (1) Such glasses are more expensive than ordinary bifocals; (2) they are more conspicuous than ordinary bifocals; (3) most important, since the near vision is limited to the small segment of the bifocals and, thereby, requiring limited fixation be imposed on the eyes, such limitation may of itself contribute to the production of symptoms. The same prescription in a single-vision glass allows the patient to hold his book in many different positions and is less likely to bring about fatigue; (4) in walking on stairs the prisms would introduce new difficulties in judging distance.

I believe that the best solution in this case would be to give this patient ordinary bifocals for constant wear, and a prism containing single-vision near glasses for prolonged near work. She could utilize the ordinary bifocals for every-day use, since she could have adequate near vision through the reading segments for the purposes usually required. It is true, they would not be so effective for prolonged reading but, for such purposes, the single-vision reading glasses could be used.

It is fortunate that this patient profited by prisms, since the data were not adequate to predict that prisms would help. It would have been important to know whether the near exophoria was measured through the reading glass because, if it were not, we could be sure that the patient had more than 12^{Δ} of exophoria while wearing the near correction. The measuring of a near point of convergence would also have been helpful, and amplitude of fusion measurements were absolutely indicated. Lastly, one might have tried the

by compression and constriction of this artery by external congestion and edema. This cessation of blood flow, verified clinically by the typical fundus picture, is a more logical explanation of the visual loss following orbital cellulitis than are other previously reported possibilities; namely, compression or stretching of the optic-nerve fibers alone.

520 Commonwealth Avenue.

REFRACTION CLINIC*

DISCUSSION BY ALBERT E. SLOANE, M.D.†

Boston.

A woman, aged 49 years, came into the clinic complaining of having particular difficulty with prolonged near vision. She was wearing: O.D., $+0.25D$. sph. \ominus $-2.50D$. cyl. ax. 115° ; O.S., $+0.25D$. sph. \ominus $-2.25D$. cyl. ax. 60° . Add $+1.75$. On checking her refraction, very little difference from the glasses she had been wearing was found. It was noted that she had at distance— 5^{Δ} exophoria, v orthophoria; near— 12^{Δ} exophoria, v orthophoria.

Uncorrected vision was: O.D., $20/50$; O.S., $20/50$. With the correction: O.D., $+0.50D$. sph. \ominus $-2.25D$. cyl. ax. 115° , vision was $20/20$; O.S., $+0.50D$. sph. \ominus $-2.25D$. cyl. ax. 60° , vision was $20/20$. With the addition: $+1.75D$. sph., the patient could read well.

The house officer ordered a single-vision lens for near, incorporating a 2.50^{Δ} base in for each eye. The patient reported two months later, and stated that she was content with her new reading glasses and that she no longer had any discomfort with near vision. She would like to have this prescription incorporated into bifocals so that she can wear them constantly.

* From the House Officers' Teaching Clinic, Massachusetts Eye and Ear Infirmary.
† Director of Department of Refraction.

therapeutic test of occluding one eye to determine whether that relieved symptoms.

QUESTIONS

House Officer: Would you not expect much poorer uncorrected vision in a person who had such a substantial refractive error?

Dr. Sloane: I would expect poorer vision, but the ability to read letters on a test card varies with many people for the same refractive error. This ability is probably related to a combination of familiarity with letters and the degree of ease with which the person may have been in the habit of getting about without glasses, a habit which promotes the accurate interpretation of blurs. In examining draftees you will note that many boys having 2D. myopia will vary in their uncorrected vision from 10/200 to 20/50.

SOLUTION

For prolonged near use, the following prescription was ordered: O.D., +2.25D. sph. \ominus -2.25D. cyl. ax. 115°; with a 2.50^a base in for near; O.S., +2.25D. sph. \ominus -2.25D. cyl. ax. 60° with a 2.50^a base in for near.

For everyday wear, these glasses were ordered: O.D., +0.50D. sph. \ominus -2.25D. cyl. ax. 115°; O.S. 0.50D. sph. \ominus -2.25D. cyl. ax. 60° (with the addition +1.75D. sph.).

A FOOT SWITCH TO CONTROL THE ILLUMINATION OF THE REFRACTING CHART*

WALTER H. FINK, M.D.
Minneapolis, Minnesota

A continuous exposure to an illuminated chart during the process of refraction, definitely lessens ocular fatigue, or for short rest periods during the refraction, more accurate concentration is possible on the part of the patient. The foot control can be used with either the projector type of chart or a

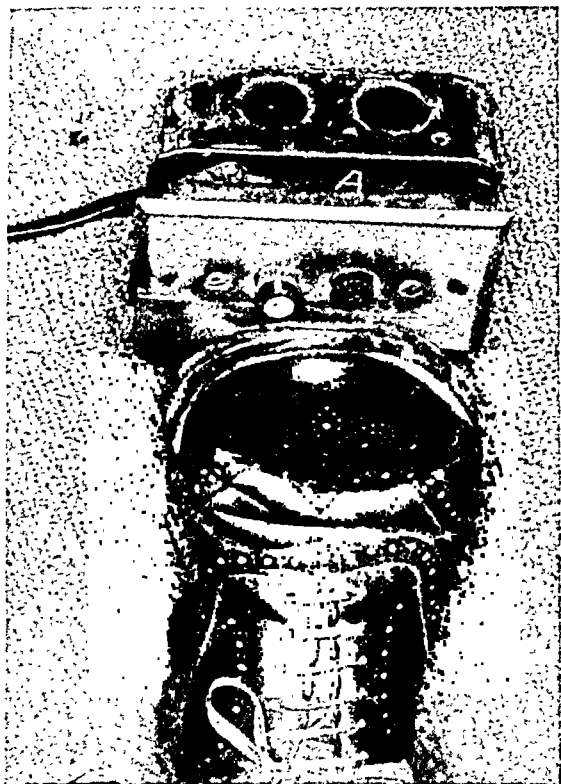


Fig. 1 (Fink). The switch is manipulated by pressure of the foot.

friction leads to early ocular fatigue and greater difficulty in concentration. In addition, a certain amount of confusion results in changing lenses when the patient constantly watches an illuminated chart. This apparatus provides an easy control of the illumination of the chart. By

chart is enclosed and painted a flat gray. The illumination is placed just inside the opening in the wall and out of sight of the patient. A movable chart is used, and only one line of symbols is exposed at a time. The movement of the chart is controlled by the examiner seated near the patient. Daylight can be used in the examining room.

1029 Medical Arts Building (2).

AN INSTRUMENT FOR TESTING BINOCULAR VISION*

WALTER H. FINK, M.D.
Minneapolis, Minnesota

The Howard-Dolman apparatus is not practical for the average oculist's office. Since its use provides valuable information, a more practical method should be found. This instrument is suggested as a substitute for it. Although it does not replace the Howard-Dolman apparatus, and its efficiency cannot be estimated in percentage, it gives the examiner—with

* Read at the eighty-first annual meeting of the American Ophthalmological Society, at Hot Springs, Virginia, November, 1945.

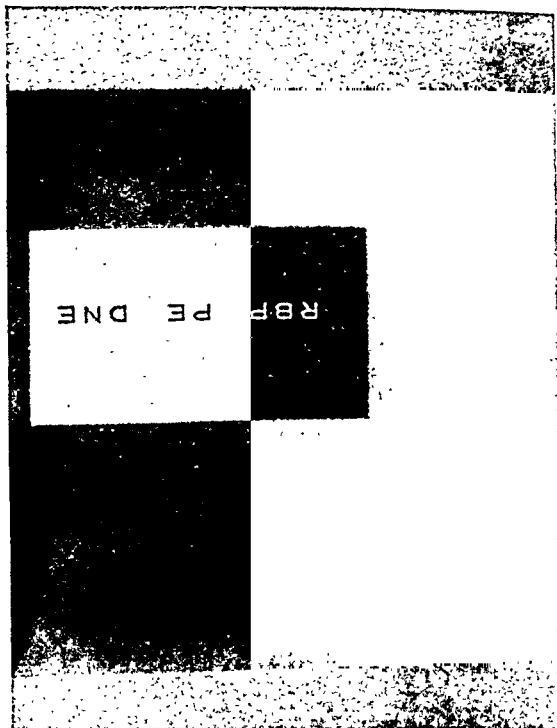


Fig. 2 (Fink). The photograph illustrates the arrangement of the recessed chart.

movable chart recessed in the wall. If the nonprojector type of chart is used, it is necessary to recess the chart in the wall 2 to 3 feet, so that when the light is off the patient cannot read the symbols. This is accomplished by having an opening $1\frac{1}{2}$ feet square in the wall and the chart recessed into the next room. The space between the wall opening and the

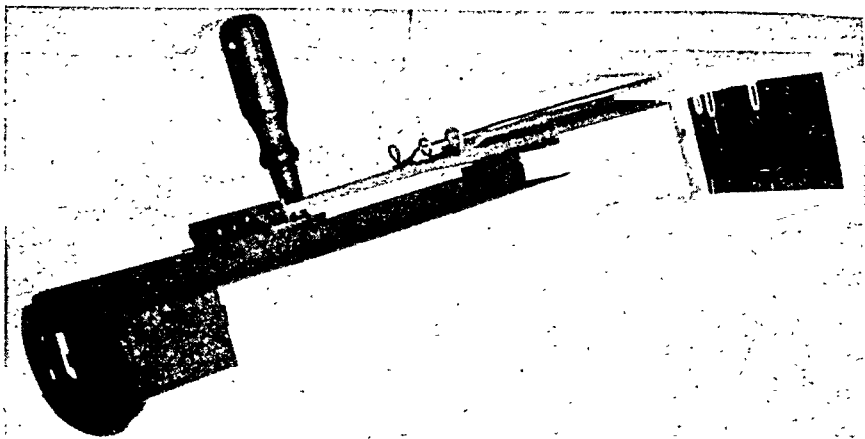


Fig. 1 (Fink). An instrument for testing binocular vision.

little effort—a comparatively accurate impression of the amount of binocular action. The instrument is simple in design and easily comprehended by young children. It is a quick, convenient check to be used to determine whether or not the patient has binocular action. The method has proved of special value as a routine procedure.

DESCRIPTION OF THE INSTRUMENT

The patient views the targets through two openings similar to a stereoscope except that no lens is used. One-half meter away are four movable vertical wires of variable diameters and one inch in

length. The position of each target is controlled by a sliding rod. These rods vary in length. The patient adjusts the movable target to the proper position by moving the sliding rod back and forth.

Immediately above these targets are four nonmovable vertical wires which are placed in variable positions and which vary in diameter. The object is to align the lower wires immediately beneath the upper wires. The size of the targets cannot be used as a criterion, because the upper wires are smaller or larger in diameter than the lower wires.

1029 Medical Arts Building (2).

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

December 3, 1945

DR. MAURICE L. WIESELTHIER, *presiding*

SHADOW CASTING DEVICE IN BIOMICROSCOPY

DR. G. KLEEFELD presented a paper on this subject during the instruction hour.

ZONULAR MEMBRANE AND ITS CHAMBERS

DR. H. MINSKY presented a motion picture on this subject.

EMBRYOLOGY OF THE ZONULE

DR. A. KORNZWEIG said the difficulties associated with the study of the development of the zonule are similar to those which are associated with the studies of all hyaline and glass membranes in the eye. These substances do not stain well, especially when they first appear. They are fragile and are immediately changed by the process of fixation and staining. The most recent theory is that the fibers are derived from the neuro-ectodermal tissue in the same way as the vitreous. This theory attempts to place the origin of the vitreous, the zonular fibers, and the internal limiting membrane of the retina under one common factor. The cell, which is responsible, is believed to be the Müller cell. It gives rise to the internal-limiting membrane through the medium of its footplates. The vitreous body, itself, may be a product of the Müller fibers because the internal-limiting membrane and the vitreous are so intimately attached. Since the ciliary body is formed by an extension forward of the margin of the optic cup, the inner layer

(the non-pigmented retinal layer), also gives rise to fibrils which, eventually, become the zonular fibers. The cells of the inner layer, which are responsible, are believed to be similiar in type to the Müller cells in the retina.

Three slides were shown. Two were diagrammatic; the third was a microphotograph of the zonular region of a four-month embryo.

TWO CASES OF DEHISCENCES OF THE ZONULAR LAMELLA IN CONTUSIONS

DR. MORRIS DAVIDSON described two cases. The first was the case of a man who was struck in his left eye by a door-check spring, in 1940. Hyphemia subsequently developed. Six months later, a tenuous, bluish membrane was found. It projected from the very small, deformed pupil and was seen floating in the anterior chamber. The iris root transilluminated, lower temporally. Maximal dilatation of the pupil disclosed a temporal lens subluxation and an incomplete choroidal rupture, lower temporally. The membrane was attached to a curved, jagged line running from the 5- to the 7-o'clock positions on the anterior lens capsule. There were no zonular fibers nor tags of them. The serrated lens equator was clearly visible, as well as the ciliary processes. An anteroposterior, subcapsular opacity was noted during the course of subsequent observations. When seen four years later, vision was still 20/200, with little increase in opacification. An interesting feature of the case was the gradual increase of myopia. A minus-two sphere combined with a minus-two cylinder corrected the refractive error when first seen; this increased gradually in six months to

a minus-five sphere with the same cylinder.

The second case was that of a 41-year-old man whose left eye was struck by a large chip, in 1943, with development of hyphemia. Six months later, on maximal dilatation, an almost complete annular detachment of the zonular lamella was found. The ring of the exposed lens capsule retained its shagreen for about a year, when it disappeared with the increasing subcapsular opacification and formation of folds in the sector where the membrane was attached.

In neither case, was there hypertension noted at any time.

PRACTICAL CONSIDERATIONS IN BIOMICROSCOPY OF THE ZONULA

DR. MILTON L. BERLINER said that there has recently been renewed interest in the morphology and dynamics of the zonular system, especially because of the increased popularity of intracapsular cataract extraction. The original concept of the zonular system's membranous structure is being revived, while the belief that it is a collection of fibers permitting free passage of the aqueous fluid of the posterior chamber is no longer universally held. The individual fibers making up the system do not end at the peripheral ridges or in the valleys between the ciliary processes. Most of them reach almost to the ora serrata and are 6 to 6.5 mm. long. The ciliary processes separate the zonule into single bundles.

Biomicroscopy, in cases where the zonule is exposed sufficiently to be accessible, is performed under high magnification, and with intense direct focal illumination in order to make apparent, by the Tyndall phenomenon, otherwise invisible structures. The pupil should be dilated, if possible, and the room darkened. Slight

movement of the beam accentuates visibility of the fibers which, even in favorable cases, can be seen only as far as the tips of the ciliary processes. The zonular fibers appear as delicate threads which glisten when viewed by specular reflection. The fibers inserting on the anterior aspect of the lens extend far axially from the equator, while posteriorly they insert closer to the equator. When the fibers are visible, it is rare to find them entirely intact, the bundles being spread apart or missing in certain areas. Frequently, torn fibers can be seen curled up at their attachment to the capsule. In other cases small white dots on the capsule mark their previous sites of attachment. Unbroken fibers attached to luxated or pathologically shrunken lenses attest to their elasticity.

It is possible that ectopia lentis, microphakia, and sphenophakia are due to a hereditary defect in the anlage of the zonule, with the fibers being aplastic or stretched. In those cases in which there is considerable tearing of the anterior zonular fibers, the anterior surface of the lens may be more curved than normal, emphasizing importance of the fibers in accommodation. When the equator of the lens is visible, irregularities can be seen at the margin where the zonular fibers are torn, indicating a retraction of the lens in the absence of zonular traction.

After inflammation—for example: iridocyclitis, if shrinkage of the lens or iris coloboma (congenital, operative, or traumatic) permits inspection—alterations in the zonule are seen. Fibers may be taut, stretched, torn, or absent. The fibers may be sheathed by pigmented or whitish deposits. In old iridocyclitis, heavily pigmented fibers appear like miniature brown cords of rock candy. These changes, indicative of zonular destruction, explain the ease with which complicated cataract can be extracted intracapsularly. They

also explain spontaneous luxation of cataracta complicata.

The frequency of dislocation after trauma shows the readiness with which the normal zonule tears; the negative pressure of the patellar fossa and the hyaloideocapsular ligament being of lesser importance in maintaining the position of the lens. When the lens is displaced, inequalities in the depth of the anterior chamber will be noted, and the edges may become undulated. Iridodonesis and phacodonesis may be present. Traumatic iritis and hemorrhage may result in deposits on the fibers. Vogt has described a case in which, after a perforating injury, there was the unusual picture of separation at the equator, by fluid of the capsule from the underlying lens substance. This was the result of increased zonular traction.

Traumatic detachment of the zonular lamella was first seen and described by Meesmann, in 1925. He noted in the area of lens displacement a "free-floating, crinkled membrane" concentric to, but separated from, the lens margin. Undoubtedly, more frequent biomicroscopic examinations of hereditary, spontaneous, or traumatic displacement of the lens will reveal such separation of the zonular membrane. Its traumatic detachment at the equatorial region in this manner proves that its nature is individual and unlike the flaky, axial separation caused by age or heat-cataract.

Discussion. Dr. Henry Minsky pointed out the possible relationship of the true concept of the zonular structure to the theory of accommodation, to the mechanism of spontaneous retinal detachment, and to some operative procedures for the relief of hydrophthalmos.

It is possible to combine the Helmholtz theory of accommodation with the views held by Tscherning, if we consider that the anterior and posterior zonular leaves be-

come relaxed, while the hyalo-zonular leaf remains taut during the active part of accommodation.

It seems, from the intimate insertion of the zonular fibers into the retina and the hyaloid, that the longer it takes to rupture the zonular fibers, the more certain is it that an extracapsular operation should have been performed. If the zonular fibers are ruptured quickly and easily, the intracapsular operation is the one of choice.

None of the four theories outlined by Duke-Elder, in considering the mechanism of detachment of the retina, succeeds in explaining the production of a spontaneous detachment resulting from sudden generalized muscular strain such as occurs in stumbling, sneezing, wrestling, or stunt flying. If we assume in these cases that, with the protective bracing of the whole body, there takes place a spasm of the ciliary muscle, we can understand how a previously diseased spot in the retina could be transformed into a hole, since the retina and hyaloid are suddenly pulled forward by means of the insertion of the zonular fibrilla in these two structures. The crescentric holes, seen clinically, all have their concave edges face forward. In the experimental production of such holes in the retina, Dr. Minsky has found that the concavity always faces the direction of pull. Since the ciliary muscle is the only part of the eye that can exert such a pull, it seems reasonable to assume that it plays a significant role. It might, therefore, be desirable to immobilize the ciliary body in the meridian of the tear by surface diathermia, as well as to seal off the hole.

In hydrophthalmos, the zonular chamber is enormously dilated. In one case, the sclera was trephined 5 mm. back of the apparent limbus, and the zonular chamber was opened without the loss of vitreous through a perforation of the ciliary body.

The tension was reduced to normal, and the diameter of the cornea was decreased from 16 to 12 mm. The scleral operations recently described by Terry and by Lehrfeld are probably related to the easy exit of aqueous from the zonular chamber.

The structure of the zonule of Zinn can be appreciated only when the observations of the gross anatomy are in complete reciprocal agreement with the interpretations of the microscopic picture. When the uveal coat is removed from the underlying structures in the fresh eye, it is found that the zonular fibers are attached more intimately to the vitreous and to the retina than to the ciliary body from which they arise. After the complete removal of the retina, a serrated white line is seen in the hyaloid at the site of the ora serrata—the hyalo-retinal ligament. If the lens-vitreous body is suspended by sutures placed in the zonular fibers, a hammocklike cradle of the zonular fibers, in which the lens rests and from which the vitreous hangs, is produced. This demonstration proves that the zonular fibers are unquestionably inserted into the hyaloid by means of the hyalo-retinal ligament.

This ligament can be recognized in microscopic slides as the plaque filling the angle between pars plana and the ora serrata. It is made up of zonular fibrilla which go to form the zonular fibers coursing on the face of the vitreous—the hyalo-zonular leaf (the “innermost” fibers of Salzmann, the “fibrae orbiculposteriocapsulares” of Garnier). The hyalo-zonular leaf forms the posterior boundary of a real aqueous space—the zonular chamber (“orbicular space” of Garnier)—and terminates in the ligamentum hyaloidea capsulare on the posterior surface of the lens. The anterior limit of this zonular chamber is bounded by the posterior and anterior zonular leaves. It may contain products of inflam-

mation and is enormously enlarged in cases of hydrophthalmos.

Dr. Berliner pointed out that Dr. Minsky indicated that there may be zonular fibers originating from the ciliary processes. He thinks most of the fibers come from the pars plana. Since some of the fibers branch as they come into the area of the ciliary processes, they may, at times, seem to run from ciliary process to ciliary process. However, they do not form actual communications between ciliary processes themselves. This can be verified in preparations made after the technique of Eggers, in which the fibers can be lifted by a glass rod. Dr. Minsky also suggested that zonular pull at the ora during accommodation may be a factor in retinal separation. According to this theory, hyperopes should be more susceptible to retinal separation than myopes.

Leon H. Ehrlich,
Secretary.

MEMPHIS SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

December 11, 1945

DR. W. D. STINSON, *presiding*

IDIOPATHIC RETINAL DETACHMENT IN PREGNANCY

DR. J. WESLEY MCKINNEY reported the case of Mrs. C. P. McK., who was seen the first time for this illness, June 24, 1944. She gave the history that one week before she had bumped her head and broken the left lens of her glasses. The blow was received on the left forehead. Immediately afterward a black spot appeared before the left eye. The night before examination, the vision became much impaired. She was seen Saturday afternoon at the hospital, and a large bullous

detachment was found involving almost the entire temporal retina. No tear was made out at this time. The patient did not care to remain in the hospital and, consequently, was sent home to lie on the left side with both eyes padded. Two days later when she reported to the office, the retina was found to be completely re-attached and looked in no way abnormal. No tear could be made out. Vision was 6/9, mostly. After lying in bed for two weeks with both eyes padded, she was given pinhole glasses which she wore for two months. Vision improved to 6/7.5, and observations at intervals revealed no change in the condition of the retina. On October 30th, however, the temporal periphery of the retina again became detached. The patient had been in bed with pads on both eyes for 10 days before she came in for this examination. There was, at this time, a minute, slitlike tear $4\frac{1}{2}$ disc diameters from the ora on the horizontal meridian. The detachment did not reach to the macula, and the retina was not elevated very high. The patient refused operation and remained in bed until the retina again became flat. She wore pinhole glasses for another two months. Gradually, it became very difficult to see the tear, and the retina maintained a perfectly normal appearance. Soon after the last episode of detachment, the patient became pregnant. The retina, however, remained apparently normal until May 2, 1945, when she was about seven months pregnant. At this time, the retina again became detached in the temporal area. A large bean-shaped tear could be seen. The diathermy operation was performed May 5, 1945. On May 10, five days postoperative, she went into labor and was delivered of a premature infant which did not live. The retina remained attached and, at the present time, the vision is 20/20, mostly, and the field is full.

CATARACT EXTRACTION WITH SECONDARY GLAUCOMA

DR. E. C. ELLETT reported the case of Mr. W., aged 42 years, who was operated in December, 1944, for cataracts in both eyes. The opacity was mostly posterior capsular, the near vision being J19. The fundi could be seen, and the veins were tortuous, but not full. Tension was normal. A simple extracapsular operation was done in each eye, three days apart. Spontaneous anterior-chamber hemorrhages occurred in the right eye on the sixth day, and in the left eye on the seventh day. The patient left the hospital two weeks after the first eye was operated upon and used atropine in each eye once a day. He returned in two weeks with tension of 41 and 52 mm. Hg (Schiotz). Vision was 6/6 and 6/24. Under miotics, the vision became normal. The tension remained high for a while but came down in a week to 25 mm. (O.U.). In May, the tension was still down, but there was a thin secondary membrane in each eye and some reduction of vision in the right eye for near (J4). A Wheeler capsulotomy was done on each eye in October, 1945. There has been no trouble with O.S. except that a miotic is necessary to keep down the tension which once went to 32 mm. Immediately following the capsulotomy, the right eye became very soft; tension was 7 mm. Under atropine, it rose in about three weeks to 40 mm., and miotics do not reduce it. On November 24th, vision was: O.U. 6/6 and J1; tension was 40 and 25 mm., the eye grounds were normal, and the fields were not disturbed.

METASTATIC CARCINOMA OF THE CHOROID

DR. ELLETT reported the case of Mrs. W., aged 44 years, who was seen in April, 1945, with the history of a blur in the right eye for two weeks and a diagnosis

of retinal detachment. Vision was 6/60, improved to 6/9. The whole field was blurred, and there was a central reactive scotoma. She had had the right breast removed in 1938, followed by X-ray treatments and no further trouble. The left eye was normal. Pupils were equal and active. The right eye showed a hyperopic blonde fundus. In the region of the ascending temporal vessels, 1 disc diameter from the disc, a white elevated area was visible under and along the vessels. It extended down toward the macula. This area was fairly well-defined. It was seen with a +5 lens. It was yellowish white with no pigment. Transillumination was negative. Tension was 20 mm. Hg (Schiotz). She was given X-ray treatment to the eye. During the summer of 1945, she died from multiple metastases in her chest.

CHOROIDAL DETACHMENT

DR. ELLETT reported the case of Mrs. C., aged 58 years, who had a combined intracapsular extraction, O.D., on June 26, 1945, and the same operation O.S. on July 2. The left eye healed without incident and vision was 6/6 and J1. On July 9th, the 13th postoperative day, the chamber in the right eye was seen to be very shallow, and a three-lobed detachment of the choroid was seen, the lobes being in, down, and out. Vision was 6/7.5. On October 22nd, the detachment was still present, and there was a small cystoid area at the center of the wound. This was treated once with trichloroacetic acid. On November 5th, when the patient was next seen, the detachment had disappeared, and vision was normal with glasses.

A CASE REPORT OF BUPHTHALMOS

DR. P. M. LEWIS and DR. G. M. WALLACE presented the case of M. A., a colored girl four years of age, who was seen in consultation with the pediatric

department of the John Gaston Hospital on December 8, 1945.

The patient's ophthalmic history began at the age of one, at which time her parents first noticed that the left eye appeared larger than the right eye. Since that time the left eye had progressively increased in size; to their knowledge the eyes had never been red or inflamed.

Ocular examination revealed relative vision in the right eye to be identity of objects. There was questionable vision in the left eye. By general inspection, one gained the impression that the left eye was proptosed, larger than normal and exotropic. The dimensions of the right cornea was 12.5 mm., horizontally, and 12 mm., vertically. Corresponding measurements of the left eye were 15 mm. and 14 mm. The depth of the anterior chamber of the right eye appeared normal; however, the depth was markedly increased in the left eye. The cornea of the right eye was transparent, but that of the left eye appeared hazy. It was 2 mm. above the center. Opacity, measuring 1.5 mm. by 1 mm., was present. Tension is either eye was not increased by digital examination. Fundoscopic examination of the right eye did not reveal any abnormality. Similar examination of the left eye revealed the disc to be cupped markedly and a marked thinning of the retina. These conditions were seen best with a minus-25 lens in the ophthalmoscope.

Diagnoses made by the pediatric department were: hydrocephalus, upper-respiratory infection, umbilical hernia, dwarfism, mental retardation, and rickets.

BILATERAL SIMPLE GLAUCOMA

DR. M. B. SELIGSTEIN presented a colored man, aged 59 years, who had noticed a skim over his left eye and failing vision in both eyes. He was hit over the right eye with a piece of stove wood

many years ago, and had not seen out of this eye since that time.

Examination showed a large cupping of both optic nerves. Perimetric fields were: L.E., small amount of concentric vision, up to 5 and 10 degrees; R.E., could not be taken. Tension with the tonometer was 32.5 mm. Hg (Schiotz). Vision was: R.E., light perception; L.E., 20/400. The tension was reduced by myotics in the left eye, only.

On September 8th, an Elliot's trephining operation was performed on the left eye, and an iridencleisis on the right eye. On October 6th, the tension was 18 mm. in the right eye, and 22 mm. in the left eye. The patient was last seen on November 15th, when tension had dropped to 8 mm. in both eyes. A spoke-wheel cataract had formed in the right eye. With a -1.25D. cyl. ax. 90°, vision in the left eye was improved to 20/200. There was a slight enlargement of the field of vision, eccentric, from 10 to 38 degrees on the lower-temporal field and 38 to 35 degrees on the upper-temporal field.

SERPIGINOUS ULCER OF CORNEA

DR. PHILIP MERIWETHER LEWIS presented a white man, aged 56 years, who was still under treatment in the hospital for a severe ulcerative keratitis.

This man was a mechanic who, on December 1, 1945, got a piece of iron rust in his left eye. The rust was removed, apparently cleanly, the following day by a general practitioner. The next day pain in the eye became severe. When first seen, exactly three days after the injury, a purulent ulcer was present. A deep crescent-shaped area of keratitis surrounded the centrally placed ulcer.

The ulcer was scraped out and cauterized, foreign protein, sulfadiazine, and penicillin were given, and the latter used

locally. Seven hours later the eye was so much worse that the anterior chamber was opened. Because of the ulcer's location and extreme severity, a Saemisch section was done. Thereafter, the wound was reopened daily. Penicillin, locally, and 20,000 units, intramuscularly, were given every three hours. Typhoid H antigen, intravenously, and sulfadiazine, orally, were also administered. Considerable improvement had occurred so that when presented, seven days after treatment was started, the cornea was clearing, and there was no hypopyon.

Clinically, this ulcer appeared to be a pneumococcic infection, but cultures failed to reveal the organism. A few Staphylococci albus and an unidentified Gram-negative bacillus were the only organisms grown in two attempts. The extreme rapidity and severity of the infection following the penetration of the cornea by a metallic foreign body were the unusual features of this case.

SYMPATHETIC OPHTHALMITIS

DR. HAROLD KUSHI (by invitation) presented a case report of sympathetic ophthalmitis following cauterization of an iris prolapse with the Ziegler cautery.

E. G., a white man, aged 51 years, was admitted to the hospital on October 8, 1945, at which time a simple intracapsular cataract extraction with peripheral iridotomy was performed in his left eye, followed in five days by a similar extraction in his right eye. No vitreous was lost at either extraction. During the removal of the corneo-scleral sutures from his left eye on the eighth postoperative day, partial iris prolapse developed. The following day a corneo-scleral suture was placed over the prolapse, and the prolapse was cauterized with the Ziegler cautery. Healing was uneventful, and the patient was discharged on the 15th postoperative

day. The media appeared clear, and the fundi looked normal at the time of discharge. Atropine was prescribed for home use.

About a month after leaving the hospital, the patient began having pain in his left eye. He was seen soon after and admitted to the hospital for treatment and observation. On entry, both eyes were markedly injected. Tension was normal; cornea and aqueous were clear; irides thickened; and pupils mid-dilated. Posterior synechiae were present in the left eye, and vitreous opacities in both eyes. Early vascularization of the left iris could be seen. No keratitic precipitates were seen with the slitlamp. Vision was perception of hand movement.

To date, the patient has had a total of 500,000 units of penicillin, 18 gm. of sulfadiazine, 4 injections of Typhoid H antigen totaling 250 million units, sodium salicylates, and, locally, atropine neosynephrine in a 10-percent emulsion. Improvement has not been marked. Pain is less than on entry to the hospital, and the patient states that his vision is better than on entry. Objectively, the findings have remained the same. A few keratitic precipitates are now visible in both eyes. The question arises as to whether this case is one of sympathetic ophthalmia resulting from the cauterization of the iris prolapse. Any suggestion as to further course of treatment and prognosis would be appreciated.

CHICAGO OPHTHALMOLOGICAL SOCIETY

December 17, 1945

PETER C. KRONFELD, *president*

(Held at the Illinois Eye and Ear Infirmary, Chicago)

CLINICAL MEETING

COLOBOMA AND ECTOPIA LENTIS IN ARACHNODACTYLY

DR. THEODORE C. ZEMAN presented a white woman, aged 20 years, who has spent all of her school days in sight-saving classes. She presented herself at the Illinois Eye and Ear Infirmary with a retinal detachment in her left eye which had occurred shortly after the extraction of an ectopic lens four months previously.

In addition to the symptoms of arachnodyly, the patient showed, in her right (unoperated) eye, an ectopia lentis in the upward and lateral direction. Upon dilation of the pupil to a diameter of 5 mm., the lower-nasal equator of the lens came into view. Instead of being circular, its visible portion had the shape of an octagon which, according to the literature, is a rare congenital deformity interpretable as multiple colobomas. The zonule was visible around the entire nasal border. The posterior segment of this eye was also unusual in that it showed a partial optic atrophy without apparent cause.

NONSURGICAL CURE OF A RETINAL DETACHMENT WITH TEARS

DR. THEODORE C. ZEMAN presented a white woman, 30 years of age, who came to the Illinois Eye and Ear Infirmary in March, 1945, with the complaint of an orange-colored film over her left eye of a few days' duration. At that time the cor-

rected vision of her right eye was: 20/30 with a $-3.00D.$ sph. $\ominus -1.00D.$ cyl. ax. 175° ; L.E., 20/200 with a $-3.25D.$ sph. $\ominus -1.00D.$ cyl. ax. 170° . The left had always been the weaker eye. Examination of this eye revealed the presence of a retinal detachment with a high degree of elevation, occupying the sector from the 10:30- to the 4-o'clock positions. Two small tears were present in the 1- and 2-o'clock positions respectively, 10 disc diameters from the posterior pole. No signs of an active or inactive uveitic process could be seen at that time. Under rest in bed and by use of pinhole spectacles, complete reattachment occurred within 11 days and has persisted up to date. The patient wore pinhole spectacles and refrained from strenuous body movements for another month. At first, no reason for this reattachment in the presence of frank tears could be recognized. Now it is apparent that each tear, though still open, is surrounded by fine chorioretinitic changes. The corrected vision in this eye is now 20/50.

BILATERAL PULSATING EXOPHTHALMOS FOLLOWING HEAD INJURY

DR. BENJAMIN E. LYONS presented a 59-year-old white woman who had been struck by a taxi two months before, after which she was unconscious for 24 hours. During her two-week period of hospitalization, she was found to have a right-parietal linear skull fracture. Since the fragments were in good approximation, the patient was treated only symptomatically. The complaints during her stay in the hospital were severe headache, diplopia, and a constant, loud, to-and-fro swishing and roaring head noise. Two weeks later, after going home, she noted that her left eye was starting to swell and protrude. This was followed in two weeks by a similar process in the right eye.

She was admitted to the Illinois Eye

and Ear Infirmary with bilateral exophthalmos, that in the right eye greater than in the left, associated with a large, red, indurated swelling of the conjunctiva of the right lower fornix. The left eye revealed only a small amount of conjunctival chemosis. There was a slight pulsation of both globes coincident with the pulse beat, which was accompanied by a to-and-fro, high-pitched, blowing bruit heard best in both temporal and right mastoid regions. There was a right papilledema of four diopters, a right total ophthalmoplegia, and a left partial external ophthalmoplegia.

This patient was presented as a case of pulsating exophthalmos, probably caused by a traumatic arterio-venous fistula of the right internal carotid artery in the cavernous sinus.

BILATERAL OPTIC ATROPHY DUE TO MENINGIOMA

DR. BENJAMIN E. LYONS presented a 37-year-old housewife who accidentally noted complete loss of the right vision 14 years ago, 8 months after an episode of mumps and right Bell's palsy. She consulted an eye physician who told her only that nothing could be done in the absence of light perception.

In May, 1945, she first came to the Illinois Eye and Ear Infirmary, complaining of blurred vision in the opposite eye. Examination revealed right facial nerve weakness, bilateral primary optic atrophy, right exotropia. Vision was: R.E., no light perception; L.E., 20/30+2, with a generally constricted visual field (5° above, 25° temporally and below, 10° nasally). X-ray studies showed: increased sclerosis of the anterior clinoid processes and thickening of the floor of the skull; also, moderate sclerosis and thickening of the inner frontal table. This was attributed to a developmental

anomaly and thought not to be clinically significant.

The patient was then referred to the Department of Neurosurgery at the University of Illinois where further X-ray studies were made and interpreted as showing destruction of the right sphenoid wing in addition to hyperostosis of the tuberculum sellae. Exploration of the skull was carried out in September, 1945, and an extensive meningioma of the right optic-nerve sheath was removed.

This case illustrates the importance of repeated X-ray studies of the skull in cases of unexplained atrophy of the optic nerve.

CONGENITAL TOXOPLASMOSIS

DR. HENRY N. RICCI presented a 13-year-old girl with a history of an acute febrile condition and convulsions at 21 months for which she was hospitalized. At this time, fundus lesions were noted and, 1½ years later, extensive bilateral chorioretinitis was found.

The convulsions were nonepileptic in nature, there being no aura, no loss of consciousness, no frothing, nor tongue biting. The attacks lasted from 10 to 20 minutes, with the patient suffering a severe headache afterward. In 1937, skull X-ray studies revealed intracerebral calcification. In 1943, a ventriculography was done which revealed dilated ventricles. During the past three years, the attacks have been occurring at greater intervals and with less severity. The last attack occurred in July, 1945. Repeated Wassermann, Kahn, and tuberculin tests with P.P.D. have been negative.

The ophthalmic examination at present reveals a corrected visual acuity of 20/30 in the right eye and 20/200 in the left. A quiescent, deep chorioretinitic lesion, 2 disc diameters in size, lies just nasal to the right disc. A similar lesion involves the macular area of the left eye. In the

vitreous, there are membranous residues of exudates.

The patient presents the classical clinical manifestations of toxoplasmosis; namely, intracerebral calcification, central nervous system disturbance as evidenced by convulsions, internal hydrocephalus, and bilateral chorioretinitis.

RUBEOSIS IRIDIS

DR. H. ISABELLE MCGARRY presented a 70-year-old white man who was admitted to the Illinois Eye and Ear Infirmary on November 7, 1942. He gave a history of diabetes mellitus and was taking 10 units of protamine-zinc insulin each morning. His fasting blood sugar was 190 mg./100 c.c. He gave a history of poor vision in the left eye for nine months and severe pain in the left eye for three months. Corrected vision was: R.E., 20/20; L.E., 5/200, not improved. The right disc was normal; there was a scatter of superficial and deep hemorrhages throughout the fundus and of old white exudates in the perimacular region. Gonioscopy revealed the right angle to be wide open without any newly formed vessels. The left eye showed ciliary injection, many fine, pigmented corneal precipitates, and neovascularization on the iris from the pupillary border down to the angle which was completely closed. There was a far advanced glaucomatous excavation. The tonometric readings at that time were normal in the right eye and around 55 mm. in the left.

Because of uncontrollable tension and severe pain, a cyclodiathermy was performed on the left eye on December 1, 1942. The operation was successful in that the eye became and has remained comfortable. The pressure, however, has remained elevated, and all vision has been lost. In the left eye, the typical picture of rubeosis iridis has developed gradually, with no elevation in tension, as yet.

ANGIOMATOSIS RETINAE

DR. A. A. BARAFF presented a 13-year-old white girl, recently reported here with vision of 20/20, corrected, in the right eye, and no light perception in the left eye. The right fundus showed innumerable discrete, whitish deposits in the outer retinal layers. The temporal periphery was occupied by a large, whitish mass which was studded with multiple, red, mulberry-like nodules. The vessels leading to this area were dilated and tortuous. The visual field showed a nasal constriction corresponding to the temporal lesion.

The left eye, blind for a number of years and in a state of atrophy, was enucleated several days ago. The posterior segment of this eye was not visible.

The case was presented as an angioma with retinal degeneration. As yet cerebrospinal and pancreatic findings are normal, and Dr. Bailey, of the University of Illinois Neuropsychiatric Institute, is of the opinion that the condition is confined to the eyes.

Electrocoagulation to the right temporal periphery will become advisable, if unmistakable signs of progression occur.

CHARACTERISTIC TYPES OF FILTERING SCARS AFTER CORNEO-SCLERECTOMY OR IRIS-INCLUSION OPERATIONS

DR. J. D. WALSH presented cases to show the difference between transconjunctival and subconjunctival filtration, the former occurring in blebs designated as type 1 and the latter occurring in blebs designated as type 2.

The microscopic substratum of the bleb of type 1 is a polycystic derivative of the conjunctiva, characterized by a thin external wall, thin septa between the cysts, and obliteration of the preëxisting blood vessels. Such blebs function by permitting intraocular fluid to pass from the

corneo-scleral fistula into the conjunctival sac, as can be demonstrated by means of the Seidel test. The sum total of the areas with thin external walls determines, *ceteris paribus*, the efficacy of the bleb. Such blebs are apt to form in areas where Tenon's capsule is absent and where the conjunctiva is thin. They are, therefore, the more common form of bleb after trephining operations, but may occur at the site of the conjunctival incision, or, in very old people, at sites of senile atrophy of the conjunctiva and Tenon's capsule. Corneal blebs are merely lateral extensions of conjunctival blebs.

Blebs of type 2 are less easily recognized. The conjunctival surface is not transformed. Only the deeper layers show succulence and obliteration of the preëxisting vessels. By gentle massage of the globe, the areas of type-2 blebs can be made to rise in characteristic fashion. The Seidel test is invariably negative, even after massage of the globe.

After most successful corneo-sclerectomy or iris-inclusion operations, combinations of bleb type 1 and type 2 are present. There appears to be no regular or demonstrable relationship between certain techniques of flap dissection and the type of bleb finally present.

SCIENTIFIC PROGRAM

1. The eye examination in the differential diagnosis of the disoriented patient. Benjamin Milder, Capt. (MC), A.U.S. (Published in this Journal, August, 1946.)

2. The scleral-resection (eyeball-shortening) operation. Dr. Derrick Vail. (Published in this Journal, July, 1946.)

3. Synkinetic and asynkinetic overaction of the inferior oblique muscle: Diagnosis and Treatment. Dr. George P. Guibor.

Robert Von der Heydt.

AMERICAN JOURNAL OF OPHTHALMOLOGY

Published Monthly by the Ophthalmic Publishing Company

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THE CHANGING SCOPE OF MEDICAL SPECIALTIES

The scope of medical specialties is constantly expanding and contracting. A brief review of the changes during the past 20 years, as compared with several other specialties, shows that ophthalmology has fared well.

In general, the layman is more interested in, and better informed about, medical problems than formerly. Magazines

and large newspapers have on their staffs writers who specialize in medical topics. The radio tells the public how to recognize cancer in the early stages; the moving pictures depict a story in which the leading character has a brain tumor; the theatre bares psychoanalysis; the advertisements tell how serious a simple head cold may be; and campaign posters tell how we can lower the incidence of venereal disease. Therefore, for the same reason that a

second-year medical student tends to become fearful lest he may have the disease to which he is introduced, the layman is more apprehensive now about his health and more frequently seeks medical advice for mere reassurance.

General surgery has been the cradle for the surgical specialties, nurturing them until they have been able to stand on their own feet as independent fields of surgical pursuit. Such has been the case with gynecology, urology, orthopedics, plastic surgery, neurosurgery, and more recently, thoracic and cancer surgery. Such will probably be the case with vascular surgery in view of the recent rapid development of new techniques in that field, such as coarctation of the aorta, portacaval anastomosis, ligation of the ductus arteriosus, and so forth.

In general medicine, the wear-and-tear diseases have increased so that the state of one's coronary arteries or the height of one's systolic blood pressure are common talk. Cardiology and allergy have emerged as specialties. The incidence of some infectious diseases has been greatly reduced and some have been practically eliminated.

Advice by the newspaper columnists, preventive medicine campaigns, school courses in hygiene including the mental phase, have all, no doubt, affected the practice of pediatrics. Complicated feeding formulas for infants have given way to more or less routine procedures so that infant feeding is no longer a major aspect of pediatrics. The use of vaccines and sera has eliminated many of the childhood diseases. Pediatrics is now more frequently concerned with the care of the premature infant and with the child's proper mental and emotional development, the aim being to prevent mental quirks, social maladjustment, or more serious nervous disturbances.

Otolaryngologists deal mostly with infection; therefore the advent of chemotherapy has narrowed their services considerably. Also, this specialty has suffered from a whispering campaign among the laymen against the treatment of sinusitis by instrumentation. The only major addition to the therapeutic repertoire of otolaryngologists is the fenestration operation.

Chemotherapy has taken the urologist out of the urethra and decreased the complications from gonorrhea. This specialty has for some unknown reason lost syphilis to the dermatologists, but its practitioners have made notable strides in the surgery of the prostate and kidney.

In neurology, less syphilis of the central nervous system is seen because the campaigns against the disease have effected better and earlier treatment. The neurosurgeons are becoming their own diagnosticians with the result that fewer neurosurgical patients pass through the hands of the neurologist. The neurologists are concerning themselves increasingly with functional and psychosomatic disorders, diseases emanating from dysfunction of the endocrines, and from allergy. Their therapeutic armamentarium has always been sparse but the electric shock treatment is quite promising.

In ophthalmology during the past two decades, we have extended our frontiers and lost little ground. The most notable addition to our surgery is the operation for detachment of the retina. The corneal transplant operation is no longer in the experimental field but is now included in the regular surgical repertoire. A dacryocystectomy is passé and has been replaced by the dacryocystorhinostomy. After some contention between the rhinologist and the ophthalmologist, this operation has now been incorporated in the domain of ophthalmology. A similar tug-of-war

has been waged over plastic work in the region of the eye with the result that ophthalmology has retained a fair portion of it. The subjects of aniseikonia and orthoptics have been developed and applied. The recognition of keratoconjunctivitis sicca as a part of the Sjögren syndrome, the appreciation of the roles toxoplasmosis, sarcoid, and brucellosis play in ophthalmology are all steps forward, and there are many other noteworthy advances which could be mentioned.

The changes in medicine occur so gradually and over such a long period that an assessment is necessary to appreciate them. Even this cursory glance at the changes during the past 20 years shows that there is a constant shifting in the scope of the specialties and that not one is static.

Algernon B. Reese.

MISGIVINGS AS TO THE TECHNIQUE OF CATARACT OPERATIONS

There is ample room for doubt as to choice of technique in performance of the operation for cataract. It is entirely reasonable to assume that various types of cataract call for different methods of approach. On the other hand, very few are the operators who throughout their professional career continue to employ exactly the methods taught to them during their early training.

That this is not merely a sign of progress from an inferior method to a better one is fairly well demonstrated by the fact that at any given period any selected group of eminent ophthalmic surgeons will be found to vary in their choice of technique. It is also significant that the statistical results recorded by the members of such a group, and the complica-

tions experienced, will differ much less widely than their choice of methods.

No ophthalmic surgeon, however eminent and experienced, is immune from failure in the results obtained by cataract operation. This is one reason why the individual operator is usually found ready to try a number of different methods in the course of his career.

Here and there a well-known eye surgeon may be found disposed to doubt whether real advance in cataract surgery has been achieved in the past half or three quarters of a century. One of these skeptics is Manuel Rivas Cherif, formerly of Madrid, Spain, but now domiciled in Mexico ("Voluntary complications in the operation for cataract." *Archivos Médicos Mexicanos*, 1946, volume 4, February, page 3). The author means precisely what he says in speaking of "voluntary" complications, for he is convinced that many of the so-called improvements in cataract technique invite trouble instead of avoiding it.

In his 34-page paper Rivas Cherif finds fault, one after the other, with many of our boasted developments in technique. From simple, he says, the cataract operation has become complicated, often to the detriment rather than to the benefit of the patient. He decries fashion in ocular surgery or a desire to adopt the new for fear of being thought antiquated, urging that too often the so-called new is merely a return to an earlier method. Unless, he says, we are sure that the patient gains, it is undesirable to occupy half an hour over an operation that ought to last five minutes at most.

As an example of the author's judgment may be mentioned his contention that in the great majority of cases it is adequate to use contact anesthesia with instillations of 4-percent cocaine solution, which he has found effective even where iridectomy

was necessary. Objections to retrobulbar anesthesia include inability of the patient to coöperate in rotation of the eye and the possibility of causing serious orbital hemorrhage or of puncturing the optic nerve. Hypotony induced by retrobulbar anesthesia, though welcomed by some surgeons, is blamed by Rivas Cherif as a serious inconvenience in the performance of extracapsular extraction. It is also, he believes, to be held responsible for the frequent occurrence of detachment of the choroid, which he regards as far more inimical to the future of the eye than is usually admitted. Akinesia he regards as not indispensable, and as unnecessarily distressing for the average patient, without possessing adequately compensating advantages. Only in very rare cases would he use canthotomy.

Rivas Cherif points out that although we all agree on the importance of a correct incision for success of the operation, unfortunately our unanimity is solely one of principle, because after having performed large, small, and medium incisions, in every conceivable part of the cornea and of the anterior sclerotic, we are still discussing this technical detail.

In the early part of the present century, a number of European surgeons experimented with the use of either one or two lance keratomes for the limbal incision. In 1928, Aubaret employed two keratomes, one in each hand, entering the eye with both at the same time; and when the two blades met he withdrew one keratome and divided the remaining corneal bridge.

Rivas Cherif still prefers the limbal incision of two fifths of the corneal circumference, and omits the conjunctival flap because of a belief that it adds to the danger of hemorrhage. He points out that an incision situated on the limbus is farther from the root of the iris than from the border of the fully dilated pupil, and

he argues that with such an incision iris prolapse is rendered less possible and iridectomy less necessary. He clings to the use of the Graefe knife for the section, as quicker and more accurate than keratome and scissors. He is, however, an adherent of the sclerocorneal suture, which he regards as having substantial advantage with practically no inconvenience.

It is natural that Rivas Cherif should express himself as to the choice between the intracapsular and the extracapsular method. He is manifestly more or less partial to the extracapsular. He states his agreement with the opinion of Van Lint that mature or almost mature cataract should be extracted without the capsule, that the unripe cataract should be extracted intracapsularly in patients whose physiologic age is between 60 and 70 years, that patients less than 60 years of age should be dealt with by the extracapsular method because the more resistant zonule renders the intracapsular dangerous, and that the extracapsular should be used after 70 because the lens masses surrounding the nucleus are not sufficient to produce secondary cataract.

Yet most of us have seen a good many exceptions to all of these rules. In spite of the downright assertion of the late T. Harrison Butler, a year or so ago, that the intracapsular was far more dangerous than any other type because of the heavy pressure he had found necessary to deliver the lens (*British Journal of Ophthalmology*, 1943, volume 27, November, page 495), it is probable that most operators of experience now undertake the intracapsular method in the majority of their cases, and regard it as generally to be preferred to the extracapsular.

Rivas Cherif's assertion that, from the day after the extraction, those operated upon by the extracapsular show much less ocular redness than those operated

upon by the intracapsular method certainly does not agree with the experience of most United States surgeons who widely practice the latter. Can it be that some Mexican surgeons (like Harrison Butler in his brief experience) are accustomed to use more pressure in intracapsular extraction than is usual among North American operators, instead of relying largely upon slow, gentle traction with the capsule forceps?

Another opinion by Rivas Cherif which seems to come down to us from the past is that "always when there is no indication to the contrary the cataract should be allowed to reach complete maturity." How many of our cataract patients lack such an "indication to the contrary"? Surely the vast majority of them, long before the worse eye reaches full maturity, are subjected to serious inconvenience as to the use of the better eye. A most important benefit conferred by the popularity of the intracapsular operation is avoidance of the long twilight period involved in waiting for complete maturity.

Earlier details of technique are forgotten, to be later revived, retried, sometimes reapproved, but seldom in the original combinations. It is well for us all, and especially for the novice, to realize that the methods now in use may not be the only ones acceptable or successful, but are just as likely to undergo further change as those which, widely used many years ago, have been swept into relative oblivion.

W. H. Crisp.

RADIOACTIVE ISOTOPES

One fact proved to us by wartime research programs as, for instance, that of the National Research Defense Committee and the Office of Scientific Research and Development, was that certain victories in investigative work can be

achieved in a vastly accelerated manner by coöperation between research scientists. Duplication of effort is reduced to a minimum, and strength and encouragement lends impetus to the whole performance when there is coördination of activity of men carrying out research on any matter of common interest. An example of the carry-over of this spirit of coördination of knowledge and essential materials for a finer type of research is the program of the Radioactive Isotope Committee of the Massachusetts General Hospital of which the Massachusetts Eye and Ear Infirmary is a part. Other research groups will do well to follow the plan of this committee, seeking consultation from the best qualified members of their respective scientific communities. Physicists from Harvard and the Massachusetts Institute of Technology serve as consultants for the radioactive isotope project at the Harvard Medical School, radioactive materials being obtained largely from the Massachusetts Institute of Technology cyclotron.

A talk given by Dr. Francis D. Moore at the Massachusetts General Hospital and abstracted in *The News* for August, offers a concise discourse on "The Application of Isotopes to Surgical Research." This abstract read, in part, as follows:

"The word 'isotope' means 'same place' or 'same phase' and denotes an element occupying the same position chemically as another element but differing from it in weight. Most of the common elements of the earth's surface are mixtures of various isotopes and, of late, the application to many problems of isotope production and detection has expanded rapidly and in many fields, ranging from determinations in submicroscopic life up to 'atomic' explosions in the air over Japan.

"The basic pattern for biologic research with radioactive isotopes was laid many

years ago when Continental workers studied some problems relative to the biology of lead, using radium as a 'tracer.' The possibilities of such methods remained limited and application to a wide variety of biologic problems was impossible until the last decade when, with the development of the cyclotron, a host of radioactive isotopes of common, biologically important elements became available. A tremendous upsurge in this type of research has since taken place, and for a few years it was almost a monthly, and even in some cases a daily, occurrence for physicists to discover a new isotope! As each element in the periodic table was bombarded with deuterons in the cyclotron, a study of the reaction products yielded many hitherto unknown isotopes of previously known elements.

"Many of these substances were radioactive and by their radioactive emissions announced their presence in the tissues, body fluids, and in the test tube.

"In its peculiar organ specificity, iodine is almost unique among the body's elements. Furthermore, the radioactive isotopes of iodine emit gamma radiation which penetrates the tissues of the patient and can be detected externally with a Geiger counter. This fortunate combination of circumstances plus a convenient half-life gave to the iodine work a peculiar clarity and interest which attracted wide attention and is quoted in most of the articles one may read on the biologic application of isotopes. This work has recently blossomed into the treatment of thyrotoxicosis with radioactive iodine and in the application of these methods to the diagnosis and treatment of thyroid tumors as well as the further elucidation of thyroid physiology.

"In 1941, under the aegis of Dr. Aub and his group, work was commenced on radioactive colloids, making some of the

common colloidal di-azo dyes radioactive by synthesis into the molecule of two atoms of radiobromine. This work was of interest because these dyes concentrate in abscesses and tumors and because one might hope by such means to diagnose abscesses from outside the patient by use of a Geiger counter or to treat tumors by injecting the radioactive dye. This work was done under considerable difficulty because of the very small amounts of radioactive substances which were available at that time. Now, with the great expansion in radioactivity research engendered by the atomic bomb and the development of the 'chain-reacting pile' as a means of producing radioactivity, these problems are being reopened and reinvestigated by workers in many places, and it is with considerable gratification that we now find workers in Philadelphia and in Berkeley, California, reinvestigating these problems with the higher amounts of radioactivity obtained from the atomic bomb plants.

"In 1942 the interests of the Surgical Service shifted to the study of water balance in burns, a problem encouraged by the government OSRD contracts, and pursued throughout the war. Up to the present time, research has been carried out on the Surgical Service employing radioactive isotopes of sodium, chlorine, bromine, potassium, iodine, phosphorus, iron, and hydrogen. The end-point detection involved in these research problems (with the exception of iron) have been carried out by our own investigators in the surgical laboratories; the radioactive materials have been obtained largely from the Massachusetts Institute of Technology cyclotron.

"The development of the atomic bomb has attracted wide public attention to the problems of nuclear physics and has made 'neutron' a household word. The develop-

ments relative to the bomb have also given rise to much interest in the research world, and we read daily in the papers of thousands of dollars being poured into work with radioactive isotopes, especially as applied to the problems of malignancy. There are many rewards to be found in this field, and many new discoveries will be made. Some will doubtless apply to the field of malignancy, but many others will be useful and important in everyday problems of the physician and surgeon.

"The types of research problems which can be investigated with isotopes can be divided into several categories:

1. "*Membrane equilibrium and permeability.* This is the basic contribution of radioactive isotopes to research. Reaction rates, permeability rates, equilibrium ratios and cell permeability can be studied with radioactive isotopes in a fashion that is impossible by other means. In this way we have studied capillary permeability, red-cell permeability, the changes in permeability of skin cells to sodium after burns, and from methods falling into this category, we may look to the future to find many answers to questions concerning water balance, electrolyte administration and pre- and post-operative care. The central problem in this therapeutic field at the present moment might be described in a few words as 'potassium deficit.' Is there a need for potassium in parenteral fluid therapy? If so, how great is the need and how does one know when the need has been satisfied? These and related problems can best be solved by the judicious use of isotopes." (Among the contributions in this category of particular interest to ophthalmologists is the work of Cogan, Kinsey, and Grant (1942) on the use of heavy water, deuterium oxide (D_2O) as a tracer for ordinary water in measuring the movement of water into and out of the aqueous, as well

as other contributions they have made using radioactive isotopes.)

2. "*'Tracing' elements or molecules in the body.* By the use of radioactive substances the distribution and reactions of various organic and inorganic compounds can be traced in the body. The classic work of Schoenheimer and Rittenberg, in which heavy stable isotopes rather than radioactive substances were used, is an example of studies in this field which have clinical significance. From their work, we find that all the protein in the body is in a constant state of flux and equilibrium, and that there is no such thing as storage or inert protein. By similar methods, we may in the future discover the site of the formation or action of various hormones, the distribution of nutritional essentials in the body, the fate of drugs and cancer-forming compounds.

3. "*The location of certain elements or molecular configurations from outside patients.* The use of iodine in this connection has already been mentioned. After iodine is given to the patient, a Geiger counter can be placed over the thyroid and the amount taken up by the thyroid can be roughly estimated. Work on the detection of abscesses has also been mentioned. Future work in this field holds much of interest relative to circulatory physiology, circulatory velocity, the effect of certain types of sympathetic surgery on circulation in various areas in the body, and other studies. In using this technique, one must always bear in mind the fallacies and pitfalls of externally placed counter measurements as they are affected by various thicknesses of tissue and other biologic factors.

4. "*The measurement of body 'areas.'* By use of isotopes one can measure with some degree of accuracy the exact amount of certain areas of body fluid in the body and the amounts of certain elements

present. This type of work is at present the main concern of the Department of Surgery as it relates to isotope investigation. We can measure the extra-cellular space with sodium and the total body water with deuterium. We can measure the total body potassium with radioactive potassium, and we can measure the degree of potassium utilization by the development of a potassium tolerance test that depends upon the urinary excretion of a measured dose of radiopotassium. In this way a chemical 'dissection' of the human body can be carried out on the living patient. Previously, a complicated quantitative analysis of a human cadaver would be the only way of getting the same data.

5. "*Treatment.* The treatment of various sorts of radio-sensitive diseases with radioactive isotopes is an obvious application of these materials. Thyrotoxicosis has been mentioned, as has thyroid tumor. Radiophosphorus has been developed as a means of treating certain types of blood dyscrasia and polycythemia vera. The future of this field lies not so much in the further application of inorganic ions to the treatment of tumors as it does in the discovery of specific organic chemical configurations which are taken up in tumor tissue and which can be rendered radioactive so as to administer selective internal radiation to tumors.

"One cannot discuss this field without stressing the hazards of radiation, and a committee has recently been formed in this hospital to review isotope research being carried out here with the hope of avoiding such hazards. The purpose of this committee is not only to correlate work and avoid unnecessary duplication or expenditure, but also to safeguard the patients and the workers from radiation which may be dangerous. Five years ago when one or two millicuries of a radioactive isotope was regarded as mammoth

production, dangers to the worker were not as great as they are now when the cyclotron can make 170 to 200 millicuries of radiosodium in a few hours. Such large amounts of activity can be dangerous to both worker and patient; realization of these hazards must be brought home to all those involved, and proper precautions taken.

"Future trends in this field will be watched with interest by physicians and surgeons alike. It is essentially a collaborative type of investigation and has always involved coöperation at least between the physician and the physicist. Now we must extend this coöperation to the various services in our hospital so that the knowledge and skill of the Medical Service, Pediatric Service, Surgical Service, and others can be brought to bear upon problems that concern us all—problems to be solved by the tools of the physicist."

I believe this abstract, as quoted above, merits our serious attention, for only by a coördinated approach, strengthened by the availability of experts in the fundamental branches of science—an approach such as is exemplified in the recommendations of the Radioactive Isotope Committee of the Harvard Medical School—can the majority of significant eye problems be solved.

S. Rodman Irvine.

OBITUARY

ROBERT VON DER HEYDT

(1875-1946)

The death of Dr. Robert Von der Heydt on September 18, 1946, was a great loss to the profession of ophthalmology and the loss of a valued and beloved member.

Dr. Von der Heydt had come to be

well-known and appreciated by a large number of men in the United States, principally because of his leadership in developing the use of the slitlamp. His earliest interest was in the mechanical side of ophthalmology, for he was a true craftsman and able to improve upon almost any optical instrument that came



ROBERT VON DER HEYDT

into his hands. Soon, however, the clinical interest dominated, and he studied biomicroscopy with Vogt in Zurich and with Fuchs and others and translated Vogt's first Atlas into English. He taught groups in post-graduate courses, gave courses almost yearly at the Academy and at the Illinois Eye and Ear Infirmary, and trained numerous individuals in this branch. Many of us went to him for advice and help, for his generosity in the sharing of knowledge and his expenditure of time for others were unlimited. He was always coöperative and kind as a consultant. Many valued his help and friendship.

Those attending the meetings came to know him for his color slides of external and fundus diseases, for he adapted ko-

dachrome to both when most men were still using black and white. He was also among the pioneers in contact-lens fittings.

Dr. Von der Heydt was born in Wiesbaden, Germany, in 1875, and came to this country at the age of six. He received his education in the Chicago schools and was sent to Germany at the age of 16. In his early manhood, he studied watch making and always carried a watch he himself had made. Working with his father on his return from Germany, it became his duty to keep the large clock at Rush Medical College in good order. It was here that he began to wish for a medical education and for a teaching position at Rush. This wish was fulfilled through his own efforts. He received his medical degree at the University of Illinois in 1903 and practiced ophthalmology in Chicago until his death.

Dr. Von der Heydt was Professor of Ophthalmology at the Chicago College of Medicine and Surgery from 1909 to 1917, Associate Professor at Rush Medical College from 1926 to 1940, and at the University of Illinois from 1940 to 1943. From 1943 until his death, he was Professor Emeritus of Ophthalmology at the University. He was ophthalmologist at the Illinois Charitable Eye and Ear Infirmary from 1905 to 1943 and was attending ophthalmologist at Michael Reese Hospital and West Suburban Hospital.

Dr. Von der Heydt was a member of the American Ophthalmological Society to which he was elected in 1930. He was a member of the American Medical Association and of the Academy of Ophthalmology and Otolaryngology, and was past president of the Chicago Ophthalmological Society.

Dr. Von der Heydt is survived by his wife, Edith Richardson Von der Heydt, and two daughters, Mrs. Franklin Briston and Harriett Von der Heydt.

E. B. Fowler.

BOOK REVIEWS

DISEASES OF THE RETINA. By Herman Elwyn, M.D. Clothbound, 587 pages, 170 illustrations, 19 in color. Philadelphia, The Blakiston Company, 1946. Price, \$10.00.

Dr. Herman Elwyn, senior assistant surgeon of the New York Eye and Ear Infirmary, divides his book, "Diseases of the Retina," into eight parts. Each part is a classification or category of the subject matter he presents, and these categories are:

Part 1, Diseases of retina resulting from disturbances in circulation; Part 2, Diseases of retina resulting from vascular malformation; Part 3, Degenerative diseases of retina on a hereditary basis; Part 4, Inflammatory diseases of retina; Part 5, Tumors of retina; Part 6, Diseases of retina leading to retinal detachment; Part 7, Developmental anomalies of retina; Part 8, Radiation injuries of retina.

The division of the subject matter of this book under these arbitrary headings was disappointing to this reviewer. It has resulted in a somewhat scattered classification and does not present the material "for students, practitioners, and ophthalmologists," as the author states was his intention, but presents it only for ophthalmologists.

In view of present-day discussions concerning the classification of fundus disease (and it would seem this should be a must in a treatise as complete as this book), one would expect the most recent classifications to be mentioned. This reviewer is aware, however, that classifications as such are merely a means to an end and not the means to further research in a subject which is so important in an age of preventative medicine.

Dr. Elwyn does bring several "new" diseases of the fundus to the attention of

the reader, diseases which, I believe, are not to be found in other texts; such as, fundus findings in endocarditis and the blood dyscrasias.

The discussion of the pathogenesis and pathology of each disease presented in this book is both well-written and well-documented, and Dr. Elwyn has been careful to bring his terminology up-to-date. The bibliographies at the end of each chapter are, however, not at all complete.

All in all, "Diseases of the Retina" is a readable book, well-written, well-illustrated, and set in exceptionally legible type that is easy on the eyes. It should find a place in every ophthalmic library.

Nathan K. Lazar.

EYE HEALTH—A TEACHING HANDBOOK FOR NURSES. Prepared and published by the National Society for the Prevention of Blindness, Inc., 1790 Broadway, New York 19, New York. Paper bound, 108 pages, 5 figures, bibliography, index. Price, \$0.60.

This is a well-arranged and useful manual, prepared particularly for the school, public health, or industrial nurse. It is surprisingly broad of scope, although of necessity compact, and gives to its reader more than an introduction to the eye and its use or abuse. Its chapters deal in part with the organs of vision, the seeing process, making the best use of the eyes, "screening" eye examinations, the eyes in childhood, eye health problems in adult life, eye safety, first aid and follow-up for eye injuries, and the teaching of eye health.

It is well and clearly written in terse sentences and should be easily understood. It is recommended not only to those for whom it is designed, but also to lay people interested in eyes and eye health, of whom there are many.

Derrick Vail.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

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| 1. General methods of diagnosis | 10. Retina and vitreous |
| 2. Therapeutics and operations | 11. Optic nerve and toxic amblyopias |
| 3. Physiologic optics, refraction, and color vision | 12. Visual tracts and centers |
| 4. Ocular movements | 13. Eyeball and orbit |
| 5. Conjunctiva | 14. Eyelids and lacrimal apparatus |
| 6. Cornea and sclera | 15. Tumors |
| 7. Uveal tract, sympathetic disease, and aqueous humor | 16. Injuries |
| 8. Glaucoma and ocular tension | 17. Systemic diseases and parasites |
| 9. Crystalline lens | 18. Hygiene, sociology, education, and history |
| | 19. Anatomy, embryology, and comparative ophthalmology |

1

GENERAL METHODS OF DIAGNOSIS

Almeida, A. de. Examination of the ocular fundus in children, as bearing upon diagnosis. *Arquivos do Instituto Penido Burnier*, 1945, v. 7, Dec., pp. 76-85.

The author discusses the relationship of ophthalmology to pediatrics, and reports a personal case of hemorrhage of the newborn, with observations of a year of investigation in the Maternity Hospital of Campinas. The author's review touches briefly on cerebral hemorrhage and hematoma, tumors and meningitis, phacomatoses, acute illnesses, and avitaminoses. (4 figures.)

W. H. Crisp.

Casanovas, J. *Radiographic methods for the localization of foreign bodies of the visual apparatus*. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, May, pp. 327-337.

After reviewing several methods of localizing ocular foreign bodies the author presents the following method. A silver ring of 0.5 mm. thick and 11 mm. in diameter is sutured to the limbus at three points equidistant from

each other. A binocular bandage is put on and frontal and lateral X-ray pictures are taken making allowance for the upward and outward rotation of the closed eye. Preliminary fluoroscopy aids in the orientation. If the radiograph has been taken properly the ring will appear perfectly round in the frontal view and as a straight line in the lateral view. A diagram is drawn consisting of two concentric circles, one of 11-mm. diameter corresponding to the limbus and the other 24 mm. in diameter corresponding to the diameter of the globe. Another diagram is drawn that consists of a 25-mm. circle, the circumference of which cuts the extremities of the 11-mm. vertical line that corresponds to the lateral view of the ring. By combining the two lines an accurate localization of the foreign body is obtained. For bone-free radiography the method of Vogt is used with the modification that a broad spatula is used to carry the dental film.

J. Wesley McKinney.

Freitas, Orlando de. *Bacterioscopic examinations of conjunctival secretions*. *Arquivos do Instituto Penido*

Burnier, 1945, v. 7, Dec., pp. 179-195. (See section 5, conjunctiva.)

Goldmann, H. A self-registering bowl perimeter with projection of the target. *Ophthalmologica*, 1945, v. 109, Feb.-Mar., pp. 71-79.

The author, in cooperation with the firm of Haag-Streit in Berne, Switzerland, constructed a bowl perimeter which fulfills all the conditions necessary for exact quantitative perimetry. Objects of various size and color and always exactly of the same reproducible degree of contrast are projected by a movable optical system onto the field of the perimeter bowl. The optical system is attached to the bowl. The movements of the projected target point are controlled by a manipulator behind the perimeter bowl. These movements can be executed in any direction, not only radially as in the usual arc perimeter. Exact fixation by the patient's eye and its control by the examiner is safeguarded by special means.

Max Hirschfelder.

Guerry, III, Du Pont. Recent advances in the diagnosis and treatment of diseases of the external eye. *Virginia M. Monthly*, 1946, v. 73, April, pp. 173-178.

This excellent paper discusses the diagnosis and treatment of external eye diseases such as blepharo-conjunctivitis, chalazion, trichiasis, molluscum nodula, herpes zoster ophthalmicus, metastatic dacryoadenitis, gonorrhea, vernal catarrh, trachoma, Parinaud's syndrome, corneal ulcers, and dendritic ulcers.

I. E. Gaynon.

2

THERAPEUTICS AND OPERATIONS

Bien, Morris. General anesthesia in ophthalmic surgery. *Amer. Jour.*

Ophth., 1946, v. 29, Sept., pp. 1119-1121.

Brown, C. A. Penicillin in ophthalmology. *Brit. Jour. Ophth.*, 1946, v. 30, March, pp. 146-167.

In this comprehensive article the author discusses the bacteriologic properties of penicillin as regards experimental data on the penetration of the drug in the normal and infected eye, and the control of infection. Clinical evidence of its action in 125 cases of infection leads him to conclude that penicillin is the ideal drug for combatting bacterial infections of the eye. It is harmless to ocular tissues and lethal to most bacteria that attack the eye. It acts equally well when applied topically for external infection and when injected into aqueous or vitreous for intraocular infection. (36 references.)

Morris Kaplan.

Fraser, I. C. and Scott, A. A. B. Penicillin treatment of ocular inflammation. *Brit. Jour. Ophth.*, 1946, v. 30, March, pp. 168-176.

The details of 38 cases of blepharitis and conjunctivitis in the treatment of which penicillin was used topically are presented in tabular form. The solution used contained 500 units per c.c. and was instilled every four hours. In eight cases lamellae of penicillin containing 180 or 100 units were used four-hourly. No other treatment was employed and the results were most striking. Blepharitis, that had existed for 20 years was cured completely in a few days. Two patients with Eales' disease were not benefited by penicillin.

Morris Kaplan.

Goldman, H. The basis of exact perimetry. *Ophthalmologica*, 1945, v. 109, Feb.-March, pp. 57-70.

The author investigated with mathematical exactness the different variables which are of importance in exact perimetry and reached the following conclusions. To perform exact relative perimetry with colourless objects adaptation equilibrium must be established, the contrast between object and perimetry background must remain constant, and the basic illumination must not change greatly. Under such conditions quantitative relations may be found between perimeter objects of varying size. A quantitative comparison of the sensitivity of individual retinal points becomes possible on the basis of perimetric data gained with objects of different size. One can characterize each point on the retina not only through its differential sensitivity, but also through its cumulative power ("Summationsleistung") for objects of different size. The cumulative power of normal retinal points may be considered constant over wide areas of the visual field. The limits of the constancy were determined in the study and it was found that distinct vision seems to decrease this cumulative power, while dark adaptation seems to increase it. Perimetry with white objects depends on the sharpness of vision with which these objects are seen. Errors of refraction, presbyopia, and cloudy media reduce the black-white visual field considerably. Patients with refractive errors should wear their glasses during perimetry. When the media are cloudy, the results of perimetry with white targets can only be used with caution in the diagnosis of disturbances in the retina or optic nerve. Colour perimetry seems to be less influenced by such blurred images.

Max Hirschfelder.

Lech Junior. Vanadium in ocular syphilis. *Arquivos do Instituto Penido Burnier*, 1945, v. 7, Dec., pp. 204-211.

The author's statistics suggest a striking advantage from the use of potassium and sodium tartrovanadate. As compared with other specific drugs, the mean time of recovery fell from four to two months, the average improvement in sight in four months was from 0.17 to 0.38. After six months of vanadium treatment, 63 percent of the patients showed vision improved to 0.5 or better. (3 graphs.) W. H. Crisp.

Mann, Ida. Intraocular use of penicillin. *Brit. Jour. Ophth.*, 1946, v. 30, March, pp. 134-146.

Experiments were done on rabbits to determine the effects of intraocular injection of penicillin in various concentrations and to determine the concentrations remaining at known intervals of time after injection. Immediately after the injection of 200 to 1500 units into the aqueous of 16 eyes a coagulum of many fine particles that completely filled the anterior chamber was observed with the slit lamp. This disappeared after several hours. A slight corneal reaction disappeared in several days. The severity of reaction did not vary with the concentration of the drug.

Injection into the vitreous produced a local opacity immediately, which eventually involved the entire vitreous. On the fifth to seventh day a severe exudative chorioretinitis appeared and progressed rapidly to complete atrophy and blindness. In four to five weeks a degeneration of the iris was noted and was accompanied by cataract in some eyes. Microscopically most of the tissues were unrecognizable. The retina, choroid, and optic nerve became fibrous.

Into six eyes chemically pure penicillin was injected with entirely different results. After a mild local reaction the fundus became entirely normal in three weeks in all eyes. The reactions in the other group were doubtlessly due to impurities in the drug.

In the second group of experiments it was found that no penicillin remained in the aqueous and vitreous one hour after the intravenous injection of 5,000 units. After injection directly into these areas the drug persisted in beneficial amounts for six hours. It was found to diffuse from the vitreous into the aqueous.

Case reports of 29 eyes treated with injections are presented. The solutions used contained from 1,000 to 50,000 units in 0.25 c.c. of fluid which is the ideal volume for injection. Results were considerably better than could be expected from any other form of treatment.

Morris Kaplan.

Missiroli, Giuseppe. The frequency of various types of pneumococcus in ocular affections and their respective sensitivity to sulfamids. *Boll. d'Ocul.*, 1944, v. 23, July-Sept., pp. 166-194.

The author made a systematic study of the distribution of the various types of pneumococcus according to modern immunologic classification. He examined 145 strains of the coccus isolated from eyes with conjunctivitis, dacryocystitis, and serpiginous corneal ulcer. Twenty-three types predominated. In a second series the author studied the sensitivity of pneumococci from sulfamido-pyridinic preparations. The types of organism differed in resistance to sulfamids. (Bibliography.)

Melchior Lombardo.

Parry, T. G. W. and Laszlo, G. C. Thrombin technic in ophthalmic sur-

gery. *Brit. Jour. Ophth.*, 1946, v. 30, March, pp. 176-178.

The authors present a preliminary report on the use of commercial thrombin (P-D) thrombin topical) as a healing agent in eye surgery. In cataract extraction they placed this thrombin paste under a large conjunctival flap and used no sutures. In squint surgery they placed the paste on Tenon's capsule or under the conjunctiva after suturing the muscles. Results were most promising. The thrombin also acted as an efficient hemostatic.

Morris Kaplan.

Scuderi, G. The action of sympamina (beta-phenyl-isopropylamine). *Rassegna Ital. d'Ottal.*, 1946, v. 15, March-Apr., pp. 94-106.

Sympamina is a synthetic drug, structurally quite similar to ephedrine. The chemistry is explained and the literature reviewed. Dropped into the eye, sympamina produces moderate mydriasis, which begins in ten minutes, has no effect upon the ocular tension, produces a contralateral miosis, and has a synergistic action with cocaine, atropine, and homatropine. The action is somewhat unpredictable and varies in different eyes. The rate of absorption through the cornea was found to vary considerably. The action of this drug varies with the pH. The preparation seems to be very similar in its effect to the other drugs of the adrenin group.

Eugene M. Blake.

3

PHYSIOLOGIC OPTICS, REFRACTION, AND COLOR VISION

Amsler, M. and Klauser, O. Measurement of high values of refraction in keratoconus. *Ophthalmologica*, 1945, v. 110, July-Aug., pp. 29-33.

The extreme values of refraction

found in conical corneas are not suitable for measurement by the ordinary Javal ophthalmometer. With the aid of the photokeratoscope of Amsler the reflex image of a disc of Placido was photographed on a series of steel balls of known curvatures. The pictures obtained can be compared with the ones obtained from the reflex image of conical corneas. In this way corneal curvature can be estimated fairly exactly. The authors offered a complete scale of steel-ball-reflex images for this purpose.

Max Hirschfelder.

Angius, T. **Experimental research on twilight vision.** (Part 2.) *Rassegna Ital. d'Ottal.*, 1946, v. 15, May-June, pp. 182-190.

Since vitamin A is essential to the formation of rhodopsin, Angius felt that there might be an increase of this substance in the periphery of the retina. The Birch-Hirschfeld adaptometer was used in the experiments. The conclusions reached were: (1) that vitamin A has no clear action in the perception of form in the peripheral field in normal subjects who are not fatigued; (2) that it has a favorable effect upon subjects exposed to intense light and fatigue; (3) that it brings about an increase in the perception of light at the periphery of the retina, and (4) that it has no appreciable action on normal individuals exposed to dazzling, if not fatigued.

Eugene M. Blake.

Bender, M. **Polyopia and monocular diplopia of cerebral origin.** *Arch. Neurol. and Psychiat.*, v. 54, Nov.-Dec., p. 323.

Cases of objective and subjective disturbances in the visual fields with associated defects in mechanisms of fixation are described. The patients had either

monocular diplopia or polyopia or both, and some of them also had symptoms of spatial disorientation. It is concluded that the rapid and involuntary movements of the eyes produced by faulty fixation tend to stimulate, simultaneously, the original macula and any new maculas which may have been formed as a result of impairment of vision.

Theodore M. Shapira.

Bender, M. B. and Teuber, H. **Phenomena of fluctuation, extinction, and completion in visual perception.** *Arch. Neurol. and Psychiat.*, 1946, v. 55, June, pp. 627-658.

In three illustrative cases of disturbances of visual fields with scotoma of varying extent and density, phenomena of fluctuation, extinction, and completion were observed.

The three phenomena appear to be related to each other. Fluctuation was characteristic in all cases, particularly on prolonged exposure. Extinction seemed to represent a more extreme form of fluctuation; since it occurred readily in areas which were otherwise characterized by fluctuation. In these areas extinction could be demonstrated frequently on double simultaneous stimulation. With rapid tachistoscopic exposure of patterns, the defects in the visual fields seemed to be reduced in their extent in all three cases. This fact suggested that these field defects (though produced by circumscribed lesions) were a result of processes of extinction rather than signs of a permanent loss in function. For that reason, rapid tachistoscopic exposure would prevent extinction and produce the appearance of completion. Completion could thus be understood as a simple absence of "extinction."

It should be considered that comple-

tion, and other phenomena described in this communication, are not confined to visual and cutaneous perception. Taken in a wider sense, they can be found to pervade the so called higher functions, such as processes of memory and thought. Studies in reminiscence are a case in point. The principles of function which are signalized in the phenomena of fluctuation, extinction, and completion may thus have general application. Theodore M. Shapira.

Bliss, A. F. **The chemistry of daylight vision.** *Jour. Gen. Physiol.*, 1946, v. 29, May 20, pp. 277-297.

Rhodopsin, a red substance obtained from the rods and known as visual purple, is the basis of scotopic vision. It has physical and chemical properties that suggest that it is a conjugated protein which liberates a prosthetic group related to vitamin A as a consequence of the absorption of light. In the living eye, dark adaptation results in the removal of vitamin A and the regeneration of visual purple. In this study of the chemistry of cone vision, Wald's discovery of iodopsin, a photosensitive cone pigment in the retina of the chicken was verified. Iodopsin resembles rhodopsin in its chemical properties but is considerably more labile. (6 figures, 5 tables, references.)

Bennett W. Muir.

Bliss, A. F. **Photolytic lipids from visual pigments.** *Jour. of Gen. Physiol.*, 1946, v. 29, May 20, pp. 299-304.

A method is described for the preservation of iodopsin, the labile photopigment of daylight vision, by freeze drying in vacuo. The lipids released by the action of light on rhodopsin and iodopsin are found to be similar and to possess a labile absorption spectrum in

chloroform, with a rising peak at about 390 m μ and a declining peak in the region of 470 m μ . After the change is complete the absorption spectrum closely resembles that of retinene. (2 figures, references.)

Bennett W. Muir.

Carlevaro, G. **An anomaly of refraction.** *Rassegna Ital. d'Ottal.*, 1946, v. 15, May-June, pp. 202-206.

The condition discussed by the author has been variously called asymmetry or decentration, bi-astigmatism, keratoconus frusto, and irregular astigmatism of the lens. Carlevaro modified the keratoscope of Gullstrand for the study of such cases of structural irregularity and he reviews the various theories offered by different observers. He concludes that the correct denomination is asymmetry and decentration.

Eugene M. Blake.

Crisp, W. H. **A device for group demonstration of astigmatism tests.** *Amer. Jour. Ophth.*, 1946, v. 29, Sept., pp. 1094-1098. (1 figure, discussion.)

Hecht, S., Hendley, C., Frank, S., Haig, C. **Anoxia and brightness discrimination.** *Jour. Gen. Physiol.*, 1946, v. 29, May 20, pp. 335-351.

Seven men and one woman, all 17 to 25 years of age, were placed under experimental physiologic conditions corresponding to variations in altitude between sea level and 17,000 feet. Using controlled brightness, the brightness discrimination was tested repeatedly with a Landolt broken ring test object. It was noted that deterioration of contrast discrimination is definite at 8,000 feet and is marked at 15,000 feet. A given increase in altitude results in a greater impairment in contrast recogni-

tion at high altitudes than at lower ones. Although the deterioration in brightness discrimination occurs at all three light intensities tested, the effect decreased as the illumination increased. Cone and rod thresholds are affected equally by low oxygen concentration. It is probable that the retina itself, rather than the central nervous system, may be the seat of the anoxic changes. (6 figures, 4 tables, references.)

Bennett W. Muir.

Hunt, G. D. **Correcting amblyopic eyes.** *The Optician*, 1946, v. 111, July 12, pp. 476-477.

Too many amblyopic eyes have been fitted with plano or balance lenses. In presbyopic patients the corrected amblyopic eye often makes an effective contribution to the work of the dominant eye.

I. E. Gaynon.

McKay-Ferguson, Olig. **The development of the theory of light.** *The Optician*, 1946, v. 111, July 5, pp. 453-454.

Descartes first definitely stated that light takes the form of minute fragments of matter traveling from object to image at high velocity. Newton discovered the composite nature of white light. Huygens' wave theory explained the phenomena of reflection and refraction. Fresnel remedied the flaw in Huygens' theory by providing a satisfactory account of the propagation of light in straight lines and explained interference and diffraction. Maxwell then brought out the electromagnetic theory, which was followed by the electron theory of Lorentz. The quantum theory as explained by Einstein, according to which the absorption and emission of energy is a discontinuous process, takes us back to the corpuscular theory.

I. E. Gaynon.

McKay-Ferguson, Olig. **Entopic phenomena.** *The Optician*, 1946, v. 111, July 19, pp. 495-499.

Entopic phenomena include all visual phenomena that arise from stimuli within the eye. Retinal blood vessels lie in front of the rod and cone layer. If light falls on the retina in such a way as to cast a shadow, the outlines of the blood vessels are observed. The spot phenomenon can probably be ascribed to the leucocytes, inasmuch as the red blood cells overlap one another and cast a continuous shadow except in capillary loops so small that cells can pass singly. Retinal arcs are usually blue and seem to extend from the light source to the projected image of the blind spot. Halos may be produced by corneal epithelium, lens epithelium, or by lens fibers, acting as a diffraction grating.

I. E. Gaynon.

Matteucci, P. **Color perimetry.** *Rassegna Ital. d'Ottal.*, 1946, v. 15, March-Apr., pp. 107-124.

The relative value of perimetry with white and colored test objects is thoroughly reviewed. The author concludes that color perimetry is more sensitive than white and that for every defect of the field found with the former there is a defect for white. It is difficult to determine accurately the peripheral limits of the field for color and there appears to be considerable difference in normal subjects, probably because of uncertainty between the chromatic sense and the sense of luminosity. Also the size of the target and the refractive error introduce further problems, as well as the question of attention and the intelligence of the subject.

Eugene M. Blake.

Moron Salas, José. **Procedure for supplying color perception to the color**

blind. Arch. de la Soc. Oft. Hisp.-Amer., 1945, v. 5, May, pp. 363-367.

The author points out that there is no corrective treatment for color blindness. It is possible, however, by training, to enable the color blind individual to distinguish to some extent colors in ordinary or known surroundings. It has also been found that the red-green color-blind person is able to distinguish colors by the use of a red glass over one eye and a green glass over the other eye. While the latter may not be practical for general wear, the use of red-green glasses can be useful in situations wherein detailed color perception is needed. The use of these glasses is a valuable aid in the process of education of the red-green color-blind individual.

J. Wesley McKinney.

Reider, N. Phenomena of sensory suppression. Arch. Neurol. and Psychiat., 1946, v. 55, June, pp. 583-590.

Clinical studies on suppression phenomenon are reported in which stimuli originating in a normal, or relatively normal, sensory field tended to inhibit or abolish the perception of stimuli arising from an "affected" field.

When this phenomenon involves vision, in the presence of normal visual acuity and normal perimetric fields, it may be mistaken for a post-traumatic neurotic reaction. The mechanisms underlying the patho-physiologic changes are discussed. Emphasis is placed on the fact that the phenomenon may be elicited not only by contralateral but by homolateral stimuli. Theoretic implications of the phenomenon are mentioned.

Theodore M. Shapira.

Roveda, J. M. Jackson's cross cylinders. Arch. de Oft. de Buenos Aires, 1943, v. 18, Oct., p. 519.

After reviewing the history and giving

the description and technique of the cross cylinder, the author concludes that this procedure is the best method for the exact determination of astigmatism. The test for power and axis are very simple. The fact that the description of the use of the cross cylinder appears more complicated than it is in reality, is perhaps one of the reasons why it has not come into more general use. The principal reasons for its efficiency are (1) its minimal influence on the accommodation, (2) the presentation to the eye under study of a simultaneous increase and decrease of the elements of the tentative correction, and (3) its rapidity. A proper setting of the cross cylinder is essential for its successful use. (Illustrations, and bibliography.)

Plinio Montalván.

Sachs, E. Abnormal delay of visual perception. Arch. Neurol. and Psychiat., 1946, v. 56, Aug., pp. 198-206.

The Pulfrich effect, a remarkable stereoscopic and sensitive phenomenon, occurs when a smoked glass or polaroid glass is placed before one eye of a person who is observing a swinging pendulum. Suddenly the pendulum appears to describe a horizontal circle, to approach the observer and recede behind the initial vertical plane. The same effect may occur if with identical illumination the transmission of impulses between retina and visual cortex is delayed. A quantitative test was done on 74 male patients. Of these, five patients demonstrated an abnormal effect, two had the effect in one eye, and 35 matched the normal Pulfrich threshold.

I. E. Gaynon.

Soto Eciolaza, J., and Olivella Casals, A. Contact glasses. Arch. de la Soc. Oft. Hisp.-Amer., 1945, v. 5, May, pp. 352-362.

The indications and contraindications for the use of the Zeiss contact glasses together with the procedures for fitting them are discussed.

J. Wesley McKinney.

Thomson, L. C. Foveal color sensitivity. *Nature*, 1946, v. 157, June 15, p. 805.

Thomson and Wright have shown that there is an increase of sensitivity to blue light as the image of the matching field is moved from the center towards the edge of the central fovea, and the explanation of the colour difference here described may be that the fixation point was such that the two halves of the field lay upon areas of the retina of slightly different spectral sensitivity. The irregular shape of the curve may be due to the fact that the image of the matching field has a retinal position which depends upon the wave length. Some difference in the anatomical position of the fixation point for red, green, and blue light has been reported by Hartridge, and it may be that the position of the fixation point is a continuous function of the wave length when small matching fields are used.

Theodore M. Shapira.

de Vries, H. Mechanism of color discrimination and a new type of color blindness. *Nature*, 1946, v. 157, June 15, pp. 804-805.

In a previous letter, it was suggested that difference in the luminosity curves are caused by varying numbers of receptors. In order to find new evidence for this, it seemed worth while to study the intensity discrimination and the visual acuity of the three sets of receptors, as these functions depend upon the number of elements.

The author concludes that a flicker photometer may be a valuable instru-

ment in the detection of color blindness (but combined with the anomaloscope), especially because the color blind can adjust the minimum of flicker very accurately. Settings which suggest unusual sensitiveness or insensitiveness to red, point to a color discrimination.

Theodore M. Shapira.

Weiman, Maximiliano. Considerations regarding contact lenses. *Anales de la Soc. Méx. de Oft.*, etc., 1945, v. 20, July-Sept., pp. 107-114.

At the end of this short article the author remarks that premature commercial propaganda, by means of moving pictures and ignorant traveling agents, has given rise to deep disappointment in many purchasers of contact lenses.

W. H. Crisp.

Woelfflin, E. Is it possible to influence the congenital disturbances of the color sense? *Ophthalmologica*, 1945, v. 109, June, pp. 324-326.

Investigations by Studnitz showed certain oily globules in the retina of baby chicks. These globules were found in the outer parts of the cones and contained three pigments of the carotinoid group. Whether it is possible to influence color blindness by the use of these carotinoids can be determined by experiment only when they become available, in sufficient quantities to be fed to subjects over a long period of time.

Max Hirschfelder.

4

OCULAR MOVEMENTS

Berens, C., and Romaine, H. H. A comparative study of sutures employed in surgery of the extraocular muscles. *Amer. Jour. Ophth.*, 1946, v. 29, Sept., pp. 1126-1134. (3 tables, 4 figures, references.)

Hartman, E. **Diagnosis and treatment of heterophorias.** *Ann. d'Ocul.*, 1946, v. 179, Feb., pp. 71-82.

After a prolonged stay in the United States, principally in New York, the author describes and evaluates the usual methods of examination and treatment of the phorias.

The tropias and phorias are defined and differentiated. Tests including the Maddox rod, cover and parallel tests for distance and near, are explained in detail. He suggests that convergence and divergence should be measured at 5 meters, and 30 centimeters. The importance of hygienic treatment is emphasized. The correction of hyperphoria is advised, and simple convergence and divergence exercises are explained.

The American methods are commented upon very favorably by the author and are here presented to French ophthalmologists. Charles A. Bahn.

Heim, M. **Nystagmus retractorius in encephalitis of Bang.** *Ophthalmologica.* 1945, v. 110, July-Aug., pp. 15-28.

Only fifteen cases of nystagmus retractorius have been published so far. There is a quick movement of the eyeball backward into the orbit followed by a slow passive return to its original position. The condition is always accompanied by a palsy of the elevators of the eyes that is usually supranuclear. The pathologic basis for the condition is damage by pressure or inflammation in the upper part of the posterior longitudinal bundle near the entrance of the aqueduct of Sylvius. The author observed a case of undulant fever of the Bang type, in which acute cerebral disturbances were found eight months after the infection. They included the above described symptoms and some

associated nuclear disturbances of the eye muscles. Encephalitis in the tegmentum near the entrance to the aqueduct of Sylvius was assumed to be the cause in this patient, but recovery occurred in two weeks without adding new facts to the picture of nystagmus retractorius. All the cases described in the literature are summarized in the article. (Bibliography.)

Max Hirschfelder.

Hermann, K., and Hall, I. S. **Sphenoidal mucocele as a cause of the ophthalmoplegic migraine syndrome.** *Trans. Ophth. Soc. U. Kingdom*, 1944, v. 64, pp. 154-164.

The clinical diagnosis of the "ophthalmoplegic migraine syndrome" has been used when there is severe unilateral supraorbital pain followed by partial or complete homolateral oculomotor paralysis. The paralysis develops quickly and recedes gradually. With recurrent attacks regression of the ocular palsy becomes less complete until eventually a more or less complete palsy remains. Bramwell suggested that the origin of this syndrome is vascular. A leaking aneurysm, or an artery or an unruptured aneurysm may make transient pressure on the affected nerve. The authors have demonstrated by means of arteriograms that congenital basal cerebral aneurysm is the commonest cause of the ophthalmoplegic migraine syndrome.

They add a case report. A man had recurrent headaches since 1924. The headaches gradually became more frequent and with each one facial pain became more severe. Six months ago the left upper eyelid became involved and the vision became blurred. A mucocele of the sphenoid sinus was found and after an operation in which the anterior

wall of the cyst was removed recovery was rapid. (7 illustrations.)

Beulah Cushman.

5

CONJUNCTIVA

Freitas, Orlando de. **Bacterioscopic examinations of conjunctival secretions.** *Arquivos do Instituto Penido Burnier*, 1945, v. 7, Dec., pp. 179-195.

The results obtained from 3,445 bacterioscopic examinations of conjunctival secretions are analyzed. About one half the examinations were in cases of conjunctivitis and about one half preoperative. In the cases of conjunctivitis the predominant organism was the Koch-Weeks bacillus, with 16.8 percent, followed by the pneumococcus with 16.1 percent. In the preoperative cases, almost one half were negative, and the positive cases showed a predominance of diphtheroid bacilli and staphylococci. (4 graphs, references.)

W. H. Crisp.

Jackson, W. P. U. **The syndrome known as "Reiter's disease."** *Brit. Med. Jour.*, 1946, No. 4466, Aug. 10, pp. 197-199.

The triad of polyarthritis of the large joints, nonspecific urethritis, and bilateral catarrhal or purulent conjunctivitis is nonvenereal and of undetermined etiology. Episcleritis and keratoderma blennorrhagia may also be part of the picture. Response to sulfadiazine therapy is good. Three cases are reported.

I. E. Gaynon.

Jona, Sergio. **Reticulo-histiocytoma of the conjunctiva.** *Rassegna Ital. d'Ottal.*, 1946, v. 15, March-Apr., pp. 81-93.

Tumors of the reticulo-endothelial system are rare and only two previous

cases of this neoplasm have been reported as occurring in the conjunctiva. Certain conditions are necessary to make the diagnosis: cells which are morphologically mesenchymal, intimate relation to the supporting fibers, phagocytic properties, and evolution towards a pluricellular type.

Jona's patient was a man, 64 years of age whose left eye showed a thick tumor of the bulbar conjunctiva of the left eye of two years duration. He concludes that such tumors result from a proliferation of the peri-adventitia of the blood vessels. Eugene M. Blake.

Mihalyhegyi, G. **A new contribution to the origin of the abscess in the bulbar conjunctiva.** *Ophthalmologica*, 1945, v. 109, Apr.-May, pp. 265-268.

Abscesses in the bulbar conjunctiva are rare. They usually occur around foreign bodies or in cases of septicemia. The author observed a patient who developed an abscess of the bulbar conjunctiva after a hordeolum, obviously through contact with the infected tissue.

Max Hirschfelder.

Svoboda, J. **Further experiences with the implantation of buccal mucosa in eye diseases.** *Casopis Lekaru Ceskyh*, 1946, v. 85, June 14, pp. 797-800. (See Section 6, Cornea and Sclera.)

6

CORNEA AND SCLERA

Alberstadt, N. F. and Price, A. H. **Corneal ulcer treated with streptomycin.** *Amer. Jour. Ophth.*, 1946, v. 29, Sept., pp. 1106-1111. (References, 1 table.)

Allenic. **Local sulfonamide therapy in hypopyon ulcers.** *Ann. d'Ocul.*, 1945, v. 178, Dec., pp. 561-566.

The author has employed sulfonamide powder satisfactorily in infectious ulcers since 1942. He uses local anesthesia but avoids the excessive use of cocaine. Two sulfonamide applications are used daily. In three years no enucleations have been found necessary in corneal ulcers, except in eyes that were lost when first seen.

In hypopyon ulcers with lacrimal impermeability and infection, in herpes, spring catarrh, and in rodent ulcers, this treatment was used as an adjunct to other therapy.

More rapid cicatrization with less degeneration apparently followed powdered sulfonamide therapy. The most favorable reactions were observed in infected phlyctenular ulcers. Subconjunctival injection of sulfamids is not advised because of frequent hemorrhage. Five illustrated cases are described.

Charles A. Bahn.

Bilger, I. A case of epibulbar carcinoma. *Göz Kliniği*, 1946, v. 3, no. 6, pp. 94-101.

A 38-year-old man was struck in the left eye by a branch. One year later a papillary neoplasm developed at the limbus. The tumor was not deeply attached and was removed surgically. Histologic examination revealed a cornified epithelial carcinoma. There was no recurrence after one year.

I. E. Gaynon.

Blaine, G., Dollar, J. M., Sorsby, A. The use of plastic materials for scleral wounds. *Trans. Ophth. Soc. U. Kingdom*, 1944, v. 64, p. 187.

The authors report on the use of plastic materials in the treatment of scleral wounds. Fibrinogen plastic, calcium alginate, and methyl methacrylate were used.

They concluded that an inert nonab-

sorbable substance does not influence wound healing in the sclera. Absorbable plastic materials such as fibrinogen and, to a lesser extent calcium alginate exercise a favorable influence.

Beulah Cushman.

Bruechner, R. A case of Sjögren's syndrome, successfully treated with Perandren. *Ophthalmologica*, 1945, v. 110, July-Aug., pp. 37-42.

Sjögren's syndrome, keratoconjunctivitis sicca, is associated with dryness in the naso-pharynx, achylia, and chronic arthritis. Elderly women are predisposed and it is not certain whether the condition is an avitaminosis or a disturbance of the organs of internal secretion. In a woman 47 years of age, the disease responded remarkably well to oral doses of male hormone (methyltestosterone, Perandren). Her symptoms immediately returned when this substitution therapy was interrupted and the patient improved with the return to the treatment. This observation makes a disturbance of the internal secretion seem probable. (Literature.)

Max Hirschfelder.

Castroviejo, Ramon. Indications and contraindications for keratoplasty and keratectomies. *Amer. Jour. Ophth.*, 1946, v. 29, Sept., pp. 1081-1089. (17 figures.)

Grossman, E. E. Conjunctivitis associated with erythema multiforme bullosa. *Amer. Jour. Ophth.*, 1946, v. 29, Sept., pp. 1146-1149. (See section 17, Systemic diseases and parasites.)

Jona, S. A study of the chemical nature of the Kayser-Fleischer ring by ultra-violet light. *Rassegna Ital. d'Ottal.*, 1946, v. 15, May-June, pp. 191-200.

Various theories as to the origin of the pigment in the Kayser-Fleischer ring are reviewed. Fleischer first stated that the source was not iron but probably biliary pigment. Later he concluded that it came from degenerated hemoglobin. Rumpel and Söldner stated that the color of the ring was due to silver, and Kubik found spectroscopically that it was urobilin. Copper was also considered to be the source of the color. Jona studied a case by filtered ultra-violet light and concludes that the pigment is neither copper nor urobilin but probably a complex organic substance not definitely determined.

Eugene M. Blake.

Klar, R. Corneal involvement in vernal conjunctivitis. *Klin. M. f. Augenh.*, 1943, v. 109, May-June, p. 385.

In a man, 22 years of age, who had suffered from the palpebral type of vernal conjunctivitis for seven years, small proliferations occurred at the limbus during one recurrence. At the same time punctate and comma-shaped subepithelial and epithelial grayish-white opacities that could be stained with fluorescein appeared in the center of the cornea. Treatment consisted of dry hot applications and 3-percent boric acid ointment. The foci gradually coalesced and other punctate and elongated opacities developed near the periphery. In the vicinity of the circumscribed limbal proliferation no corneal lesions were seen. The process healed completely without leaving permanent opacities. (References.)

F. Nelson.

Kuo, P. K. Incipient pannus as a sign of the primary corneal infection of trachoma and as an important criterion for the early diagnosis of the disease. *Amer. Jour. Ophth.*, 1946, v. 29, June,

pp. 645-654. (5 figures, 3 tables, references.)

Larsen, Victor. Eye diseases caused by hydrogen sulphide in tunnel workers. *Acta Ophth.*, 1944, v. 21, pt. 4, pp. 271-286.

During the construction of a tunnel under the Sund fifty workers suffered from 163 attacks of acute keratitis with severe pain, photophobia, lacrimation, and the development of corneal vesicles which ruptured within 24 hours. Thorough investigation revealed that the exciting agent was hydrogen sulphide, liberated from the decay of organic substances at the bottom of the sea and from anaerobic fermentation. The ocular symptoms became more severe after the men returned to fresh air, because hydrogen sulphide has a slight anesthetic action. These attacks were finally eliminated by ventilation sufficiently powerful to drive out the gas. Ray K. Daily.

Lutman, F. C. and Favata, B. V. Keratoconjunctivitis sicca and buccoglossopharyngitis sicca with enlargement of parotid glands. *Arch. of Ophth.*, 1946, v. 35, March, pp. 227-240. (See Section 14, Eyelids and lacrimal apparatus.)

Magitot, A. Allergic conjunctivides and keratitides. *Ann. d'Ocul.*, 1945, v. 178, Aug., pp. 321-334. (See Section 5, Conjunctiva.)

Malling H. Congenital parenchymatous (non-luetic) keratitis. *Acta Ophth.*, 1944, v. 22, pt. 2, pp. 141-146.

Two cases are reported and a similar observation reported by Tertsch is briefly referred to. An infant was seen when one month old, with a bilateral corneal affection resembling parenchy-

matous keratitis. The lesion was characterized by scattered, fairly massive, diffuse grayish spots in the corneal parenchyma, and deep vessels extending 1 to 3 mm. into the cornea. The left cornea was macerated with large epithelial erosions, especially in the center. Several months later the lesion had healed. The right cornea was left with a few scattered nebulae and the left with dense central maculae. The other patient, a woman 40 years of age, had massive, smooth, irregularly circumscribed maculae in the lower portion of each cornea, distortion of the pupils, and left anterior polar cataract in the left eye. The pathogenesis of the affection is discussed, and it is believed that it is an extrauterine inflammatory affection. (Illustration.) Ray K. Daily.

Mann, Ida, Pirie, A., Tansley, K., and Wood, C. Some effects of vitamin-A deficiency on the eye of the rabbit. *Amer. Jour. Ophth.*, 1946, v. 29, July, pp. 801-815. (1 color plate, 2 charts, 2 tables, 6 figures, references.)

Odegaard, Kristian. Purulent conjunctivitis with keratitis caused by *Neisseria intracellularis* (meningococcus). *Acta Ophth.*, 1944, v. 21, pt. 4, pp. 295-302. (See Section 5, Conjunctiva.)

Owens, W. C. Streptomycin treatment of a corneal abscess caused by *escherichia coli*. *Amer. Jour. Ophth.*, 1946, v. 29, August, pp. 1007-1009. (References.)

Panzardi, D. The Stähli's corneal line in trachomatous patients. *Boll. d'Ocul.*, 1944, v. 23, July-Sept., pp. 195-205.

With the slit lamp the writer systematically studied the condition of the cornea of 100 patients with old trachoma. In all of them there was super-

ficial linear horizontal pigmentation in the lower half of the cornea that resembled the senile line of Stähli. The line had a decided horizontal course and was curvilinear or broken. The position of the line corresponds to the palpebral fissure through which an irritating substance or evaporation could cause further damage to the already badly affected cornea. (Bibliography.)

Melchior Lombardo.

v. Papolczy, F. Pathogenesis and therapy of serpiginous corneal ulcer. *Klin. M. f. Augenh.*, 1943, v. 109, May-June, p. 361.

Serpiginous corneal ulcer can occur at any age and in both sexes. The incidence is higher in males (65 percent) and after 40 years of age. Coexistent dacryocystitis was observed in 25 percent of patients. In 25.34 percent of the patients pneumococci were found, in 36.9 percent staphylococcus albus, and less commonly staphylococcus aureus, diplobacillus, streptococcus, and xerosis bacillus. Even the last species can produce the disease. It is recommended that cultures be taken not only from the secretion of the conjunctival sac but also from the ulcer itself. Local treatment with wetol, a preparation of vitamins A and D and iodine in linseed oil or cod-liver oil, proved most beneficial. The author used a mixture of equal parts of wetol and cod-liver oil, which is not only a strong antiseptic but also a stimulant of tissue growth. In addition he advocates such surgical procedures as cautious removal of the overhanging edge of the ulcer, cauterization, removal of exudate from the anterior chamber, trephining, and paracentesis. (References.)

F. Nelson.

Pavisc, Z. Treatment of serpiginous ulcer with the sulfapyrimidine prepara-

tion "Debenal." *Ophthalmologica*, 1945, v. 109, Apr.-May, pp. 227-235.

Fourteen cases of seriginous ulcer of the cornea which were treated orally with sulfapyrimidine are reported. The results were satisfactory in ulcers that were not too far advanced. The drug was well tolerated by the patients, all of whom were over 47 years of age. Only in far advanced ulcers were other measures such as steam cautery and conjunctival covering necessary. The literature on the subject of local and general sulfonamide therapy of seriginous ulcers is briefly reviewed. (Bibliography.) Max Hirschfelder.

Pirie, A. Ascorbic acid content of cornea. *Biochem. J.*, 1946, v. 40, no. 1, pp. 96-100.

The ascorbic acid content of corneas of cattle and rabbits was determined when excised immediately after death, and after chemical damage had had time to occur. The concentration in the epithelium was found to be much higher than in the stroma. About one half the total amount of ascorbic acid in the cornea was found in the epithelium. The amount in the stroma was about equal to that in the aqueous. It was deduced that the endothelium is permeable to ascorbic acid. After injury with $\beta\beta'$ -dichlorodiethyl sulphide the concentration of ascorbic acid in the cornea was decreased. (5 tables, references.) Bennett W. Muir.

Richards, J. M. and Romaine, H. H. Keratoconjunctivitis sicca. *Amer. Jour. Ophth.*, 1946, v. 29, Sept., pp. 1121-1125. (See section 17, Systemic diseases and parasites.)

Riise, Per. Transplantation of the entire cornea. *Acta Ophth.* 1943, v. 21, pt. 1-2, pp. 26-30.

In two eyes in which the cornea had been lost through a seriginous ulceration so severe that iris and lens were exposed, an entire cornea was implanted. In one case the implant was taken from a cadaver, and in the other from an eye enucleated because of a choroidal tumor. Both implants took. Five months after the transplantation one cornea was opaque peripherally, but clear enough in the center to permit visibility of the pupil. Vision was hand movements in front of the eye. The second case was in its ninth post-operative day when this report was made. (2 photographs.)

Ray K. Daily.

Rønne, Henning. Xerophthalmia in Denmark in the period 1882-1942. *Acta Ophthal.*, 1944, v. 22, pt. 3, pp. 237-242.

A graphic survey points out the close relation between the incidence of the disease and lack of vitamin A in the diet.

Ray K. Daily.

Sezer, D. N. Hereditary corneal dystrophy. *Oto-Nöro-Oft.*, 1946, v. 1, pp. 6-15.

The author reports the first three cases of corneal dystrophy in Turkish literature. In a man, 45 years of age, white subepithelial plaques coalesced to form a discoid opacity in the central area of each cornea. In a man 24 years of age, who had complained of poor vision for five years, biomicroscopic examination revealed many small brown and gray opacities of varying size in the superficial layers of the parenchyma in the pupillary area of each cornea. The epithelium was irregular and nodular. In the third case a man 21 years of age complained of decreased vision, pain and photophobia. The entire cornea seemed veiled owing largely to the

increased reflection in the region of Bowman's membrane. I. E. Gaynon.

Smith, Arthur. Survey of the treatment of traumatic corneal ulcer. 1941-1944, Royal Hospital, Sheffield. Brit. Jour. Ophth., 1946, v. 30, March, pp. 178-186.

By means of graphs 262 cases of corneal ulcers are analyzed. Annual incidence, age, length of stay in hospital, visual acuity, and vision as related to age are considered. Treatment consisted of intravenous protein therapy combined with internal sulfonamide administration. Cauterization was purposely omitted and results were uniformly good. Morris Kaplan.

Summers, T. C. Penicillin and vitamin C in the treatment of hypopyon ulcer. Brit. Jour. Ophth., 1946, v. 30, March, pp. 129-134.

Twelve cases of hypopyon ulcer are reported. Treatment consisted of immediate cauterization, instillation of penicillin (200 units per c.c. every hour during the day and every three hours during the night) and atropine, the constant use of a hot pad, short wave diathermy, and an injection of 500 mg. of vitamin C. Results were much superior than with regimens previously used. The author believes that penicillin and vitamin C combined are considerably more effective than either alone. (13 colored illustrations.)

Morris Kaplan.

Svoboda, J. Further experiences with the implantation of buccal mucosa in eye diseases. Časopis Lekarů Ceskyh, 1946, v. 85, June 14, pp. 797-800.

Implantation of buccal mucosa according to Denig was carried out in 47 patients with trachomatous pannus. Of

22 who were examined one year after the operation, irritation was present in two and six had recurrence. Of 114 patients operated upon for pterygium, seven had insufficient cosmetic improvement and seven had recurrence. Sixteen patients were treated by this method for burns with satisfactory outcome in all but two. O. Felsenfeld.

Thomas, C. I. Corneal transplantation and preliminary iridectomy. Arch. of Ophth., 1946, v. 35, Feb., pp. 170-172.

Iridectomy is recommended as a preliminary to the corneal transplantation operation for the following reasons: it enables the surgeon to estimate the amount of postoperative reaction that may follow; it allows for more rapid refilling of the anterior chamber; a prolapse of the iris into the wound after the transplantation is less likely. Iridectomy may prove dangerous and should be approached with caution in an eye which has the relatively unfavorable, deeply scarred, somewhat vascular cornea and in which, when the anterior chamber is opened, the iris is found to be smooth and bound down tightly to the lens. Loss of vitreous frequently follows an attempt to do an iridectomy in such an eye.

John C. Long.

Valerio, M. Keratitis sicca and keratitis filamentosa. Rassegna Ital. d'Ottol., 1946, v. 15, March-Apr., pp. 144-151.

Keratoconjunctivitis sicca is simply the expression of the corneal and conjunctival alterations which are the natural consequence of a destruction of the secretory tissues of the lacrimal gland, and independent of the factors which cause this destruction. The presence or absence of filaments upon the

cornea has no particular significance, except that it is one of the principal causes of the patient's discomfort. There is another form of filamentous keratitis, that is seen in herpes of the cornea.

Eugene M. Blake.

Verdaguer, Juan (P). Therapy of superficial keratitis. Arch. Chilenos de Oft., 1945, 1st yr. May-June, July-August, nos. 6 and 7, p. 13.

The subject is discussed under the following heads; morphologic description of epithelial keratitis, etiology of superficial keratitis, infectious keratitis, degenerative keratitis, relapsing erosion of the cornea, other indications for subconjunctival autohemotherapy.

W. H. Crisp.

Werner, K. The treatment of serpiginous corneal ulcer with the sulfonamid preparation Cibazol. Klin. M. f. Augenh., 1943, v. 109, May-June, p. 376.

Of 30 serpiginous ulcers that varied in size from 1.5 to 6 mm., 27 were treated successfully with cibazol given internally. Locally only scopolamine was instilled. The patients were kept in bed and the diseased eye was bandaged with a metal shield. Fifty percent of the eyes were infected by pneumococci, the remainder by staphylococcus pyogenes aureus and citreus, xerosis bacillus, streptococcus viridans, and colon bacillus, either alone or as part of a mixed infection. The average stay in the hospital was eight to nine days. Two patients were treated ambulantly. Two of the three eyes that did not respond to the treatment became blind from spontaneous perforation, and in one resistant recurrences made electrocauterization necessary. No surgical methods except extirpation of infected tear sacs were used. Resulting vision in nine patients was 1.0, in 11 it was

between 0.5 and 0.9, and in five it was less than 0.5. (References.)

F. Nelson.

Woods, A. C. Nummular keratitis and ocular brucellosis. Arch. of Ophth., 1946, v. 35, May, pp. 490-508.

In a previous paper published in collaboration with Guyton, it was suggested that in some instances the nummular keratitis of Dimmer, might be due to an infection with Brucella. Several further observations have been made which strengthen this opinion. The clinical and experimental observations which prompt this belief are presented.

A complete discussion of the history of the terminology is given.

The confused literature on nummular keratitis suggests that more than one clinical entity may have been described under this term. Five isolated, sporadic cases are reported. In all of the patients the classic picture of nummular infiltrates in the cornea and, likewise, serologic or allergic evidences of brucellosis were present. A typical nummular keratitis can be produced in experimental animals by proper inoculation of the eyes with Brucella organisms. It seems probable that some of the nummular keratitis reported may actually have been corneal brucellosis. The term Brucella nummular keratitis is suggested.

R. W. Danielson.

Effect of antiseptics on regeneration of corneal epithelium. Bull. U. S. Army Med. Dept., 1946, p. 257.

The corneal epithelium was rubbed off by gauze in the previously cocaine-ized eyes of a number of adult rabbits. The right eyes of the rabbits were treated with normal saline solution in a quantity similar to the drug solutions used in the left eyes. The solutions used

in the left eyes were: aqueous solutions of mild silver protein, 10-percent; zinc sulfate, 0.5-percent; mercurochrome, 2-percent; phemerol, 1:2,500 in 2-percent boric acid solution; mercuric oxycyanide 1-5,000; metaphen 1-2,500; merthiolate 1-2,500; acriflavine 1-1,000; zephrian chloride 1-3,000; penicillin 2,500 oxford units per c.c.; and sodium sulfathiazole, 2-percent.

During the first 24 hours the right and left eyes of each rabbit had equally hazy corneas and equal conjunctival congestion. Within four to six days the right eyes were clinically normal, whereas the left eyes had large denuded areas.

The investigators concluded that the local antiseptics ordinarily used in ocular therapeutics considerably delayed the healing process in the corneal epithelium of rabbits. In most instances the use of these drugs resulted in a permanent opacity of the cornea. The histologic changes in all the corneas that were examined were alike, which suggests that all the chemicals produced the same nonspecific irritation. Sodium sulfathiazole and penicillin neither delayed regeneration nor produced opacities.

The authors feel that the use of common local antiseptics should be limited to those injuries in which there is a probability of infection. F. M. Crage.

7

UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Atkinson, Donald. The artificial pupil in the restoration of vision. *J. Internat. Coll. Surgeons*, 1946, v. 9, May-June, pp. 365-369.

The author presents four cases and discusses his simplified method of creat-

ing an artificial central opening in the iris in aphakic eyes in which the pupil has been sealed by exudates. This consists of a corneal section in which the knife, cutting edge downward, is made to penetrate the cornea 4 mm. from the limbus, after which it is forced through the iris and passed forward 6 mm. where it again enters the anterior chamber. The counter puncture in the cornea is made and the section is not finished, as the elasticity of the iris will cause a coloboma to occur. The knife is then withdrawn. (Four figures.)

I. E. Gaynon.

Emmelin, N., and Palm, E. On the presence of histamine in aqueous humor. *Acta Ophth.*, 1944, v. 22, pt. 2, pp. 117-130.

The material for this laboratory investigation consists of the aqueous of the cat, dog, rabbit, and ox. The intestine of the guinea pig was used as the test material, for histamine produces muscular contraction. The data, reported graphically, show that a biologically active substance is present in the aqueous of these animals, which causes histamine-like contraction of the guinea-pig intestine and a bronchial constriction. The substance producing these reactions is destroyed by boiling in alkaline, but not in acid solution. The effect on the guinea pig intestine is counteracted by thymoxietyldiethylamine but not by atropine. The intravenous injection of histamine raises the blood histamine content but does not increase the histamine content of the aqueous.

Ray K. Daily.

Esteban, Mario. A rare postoperative complication: iridocyclitis from penetration of a greasy substance into the eye. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, May, pp. 378-384.

A postoperative iridocyclitis beginning on the eighth day after an uncomplicated intracapsular cataract extraction is reported. The eye was very painful for more than two months. A small globule of grease was noted on the hyaloid membrane with the slit lamp. It was thought to be a particle of ointment that had been introduced into the eye at the time of operation. Chemical irritants given off by the grease caused the iridocyclitis. The particle was not absorbed but eventually seemed to be at least partially encapsulated by fibrin from the iris. J. Wesley McKinney.

Franceschetti, A., Valerio, M., and Babel, J. Recurrent aphthous uveitis with mucocutaneous lesions. *Arch. of Ophth.*, 1946, v. 35, May, pp. 469-489.

During the last few years a new syndrome has been described in the European literature of dermatology and ophthalmology, a syndrome characterized by periodically recurring uveitis and a group of mucous and cutaneous symptoms.

The clinical evolution of this disease is characteristic. It affects young people, generally between the ages of 20 and 30 years, and evolves slowly over a period of years. The illness is essentially characterized by its recurrence, and especially by the periodicity of the attacks.

The beginning of the illness is insidious and is characterized by the sudden appearance of banal buccal aphthae. Uveitis is in general the characteristic and dominant feature of the syndrome. No specific or valuable treatment has been found.

The authors report five cases in detail and discuss the various theories of etiology. Of the various hypotheses, that of a virus infection seems the most probable, although it is necessary to

introduce another factor, which is the sensitization of the organism. This allergy, however, seems to be secondary, and not the initial cause of the disease as in the analogous ocular disorders of the rheumatic type.

The extremely frequent coexistence of gastrointestinal disturbances should be remembered. (57 references and 4 figures.) R. W. Danielson.

Godtfredsen, Erik. The frequency of secondary carcinomas in the choroid. *Acta Ophth.*, 1944, v. 22, pt. 4, pp. 394-400.

Six cases of metastatic choroidal tumor were found among 8,000 patients with cancer at the Radium Center. They constituted between one-third and one-half of the total number of intraocular tumors. Contrary to published data this investigation shows that metastasis in the choroid from pulmonary and mammary cancer is equally frequent. Ray K. Daily.

Godtfredsen, Erik. Choroid metastases in chorionepithelioma of the testicle. *Acta Ophth.*, 1944, v. 22, pt. 3, pp. 300-310.

The literature contains five cases of ocular metastasis of a chorionepithelioma; three in women, and two in men. The author's patient a man, 18 years of age, died one year after the appearance of this tumor in the testicle and 20 days after the appearance of the ocular metastasis. Autopsy revealed metastases in the internal organs and cerebrum. (Microphotograph.)

Ray K. Daily.

Guglianetti, L. A new symptom of sympathetic ophthalmia. *Rassegna Ital. d'Ottal.*, 1946, v. 15, nos. 1 and 2, p. 5.

Since sympathetic ophthalmia manifests itself predominantly in the an-

terior segment or the posterior segment of the eye, Guglianetti inquired whether there might be early changes in the field of vision which would be diagnostic. Using the Maggiore perimeter and reduced illumination he found an annular scotoma between the macula and the periphery both for white and colored test objects in two patients. A third patient revealed a ring scotoma about the macula very early in the course of the disease. Further studies are necessary to determine the value of this test. Eugene M. Blake.

Haar, M. **Reiter's disease.** *Acta Ophth.*, 1945, v. 23, pt. 2, pp. 143-150. (See Section 5, Conjunctiva.)

Hebert, Emile. **An exceptional complication of furunculosis.** *Ann. d'Ocul.*, 1945, v. 178, Dec., pp. 556-560.

A man, 25 years of age, with anthrax, developed a furuncle in the left nose with ocular redness, and iritis in left eye. One week later the anterior ocular inflammatory symptoms subsided. A white spot as large as the optic disc and a small hemorrhage were observed near the macula. Choroidal detachment in one of the upper quadrants in each eye followed probably as a result of a choroidal lesion. One month later the detachment had completely disappeared in the right eye, but not in the left eye. Sulfonamides were not well tolerated. Two months later only photophobia and small spots in the retina with slight striation persisted. The sudden onset, normal tension, and normal transillumination made choroidal tumor seem unlikely.

Pathologically the condition was a staphylococcus septicemia involving the orbit and uveal tract with a bilateral choroidal detachment. The detachment

was attributed to suprachoroidal inflammation. Choroidal detachment is not infrequent after intraocular operations and usually becomes reattached without serious complications.

Charles A. Bahn.

Herrmann, Heinz. **Enzymatic oxidations in ciliary processes.** *Bull. Johns Hopkins Hosp.*, 1946, v. 78, March, pp. 119-125.

Separated fractions of the cell debris of the epithelium of the ciliary processes were studied for their chemical composition and their enzymatic activities. Marked differences were found in both these factors. Different types of granules contain enzyme aggregates of different composition which could vary the local variation of cellular metabolism. Francis M. Crage.

Krause, A. C. and Smith, L. F. **The therapeutic treatment of uveitis associated with toxoplasmosis.** *Amer. Jour. Ophth.*, 1946, v. 29, August, pp. 977-980. (References.)

Larsson, S., and Osterlind, G. **Studies into the causes of senile miosis and rigidity of the pupil.** *Acta Ophth.*, 1943, v. 21, pt. 1-2, pp. 1-25.

The authors review the literature and report 14 cases which they investigated. The 14 patients, 69 to 85 years of age, were subjected to a detailed preoperative biomicroscopic examination of the rigidity and structure of the iris. Most of the eyes had a more or less pronounced depigmentation of the free iris border, and in a number of cases the depigmented border was transformed into a structureless grayish-white homogeneous membrane. These changes in the iris had no definite relation to the degree of pupillary mobility, and were

not proportionate to the extent of histologically verifiable hyaline degeneration in the iris.

Segments of iris were excised and examined histologically.

The histological changes were principally sclerosis of the iris vessels, and more or less extensive hyaline degeneration near the free pupillary border and in the connective tissue layer between the sphincter and the pigment epithelium. The extent of these changes appeared to be in close relation to the degree of pupillary mobility. Atrophy and degenerative processes in the sphincter and dilator of the pupil were found in a number of the iris segments, and it seems certain that extreme rigidity of the pupil is always associated with these changes in the iris musculature. The anatomical background of senile miosis is thus shown to be primarily arteriosclerosis of the vessels of the iris, hyaline changes of the stroma, and degeneration of the musculature. Each one of these changes will make normal dilatation more difficult, but not impossible. All the changes combined and in advanced stages result in complete immobility of the pupil.

Ray K. Daily.

Lund, Axel. Chronic iridocyclitis. *Acta Ophth.*, 1944, v. 22, pt. 2, pp. 176-192.

The case histories of 88 patients treated at the Finsen Institute were analyzed for data on the effectiveness of the treatment, etiology, and prognosis. The average period of observation was five years. The treatment consisted principally of carbon arc light baths and injections of tebeoprotein. Thirty patients were men and 58 women. The morbidity is greatest between the ages of 20 and 30 years, and

in women there is a rise in the morbidity near the age of 50 years. The average duration of the disease was 14½ months; it had a marked relation to the age of the patient at the onset of the disease; 39 months for patients under 20 years of age, and 7 months for people over 50. Of 151 eyes 136 became quiescent, although there were relapses in 56 eyes. As a rule the relapses were mild. Nearly one half of the eyes recovered with normal vision. Sixty-three percent had good reading vision, and 23 percent had orientating vision. The poor visual results were due to complications, such as secondary glaucoma, central lesions, optic neuritis, retinal detachment, and cataract. In all patients except those who had cataract the poor visual results were irreparable. Nine patients with a cataract were operated upon; in five the result was good reading vision. In one there was a recurrence of the inflammatory process. One half of the patients had roentgenographic evidence of lesions in the lungs.

Ray K. Daily.

Marback, H. Spontaneous cyst of the iris. *Arquivos Brasileiros de Oft.*, 1946, v. 9, Feb., pp. 1-9.

A woman, aged 27 years, came complaining of a small spot on the right iris, said to have been noticed only for the past 12 years. The eye was normal in every other respect and the visual acuity was 1.0. The iris moved freely. The pupil was slightly oblong. In the anterior chamber, in the region of the chamber angle between the 9:30 and the 10:30 o'clock positions, was seen a small cyst, hemispherical in form, and whose radius was from 1.5 to 2 mm. in length. Dilatation of the pupil demonstrated the absence of synechia. Under the biomicroscope, the walls of

the cyst were transparent and extremely thin. There were two small pigmented areas in the posterior wall, and the anterior wall contained meshes of iris stroma and was traversed by capillaries. The patient was urged to undergo excision of the cyst by means of an iridectomy, but refused such action on account of the absence of inconvenience from the cysts. After $2\frac{1}{2}$ years no appreciable change was discovered in size or appearance of the cyst. (References.) W. H. Crisp.

Matthews, G. W. and Hollabaugh. Uveitis with secondary glaucoma. Bull. U. S. Army Med. Dept., March, 1946, p. 364.

A white male, aged 42 years, was hospitalized for a painful, moderately congested left eye. The vision was 20/200, tension (Schiotz) 40 mm., the vitreous was cloudy, and the cornea had a few deposits on its posterior surface. There was no visible choroidal lesion. The diagnosis was acute uveitis with secondary glaucoma.

Laboratory tests and clinical examinations were negative. X-ray films revealed a small lower fourth molar completely covered by bone. After removal of the tooth caseous exudate escaped. Adjacent to the tooth and posterior to it was a large rough cystic sac.

Two days after operation the eye was free from pain, and tension was 20. Two weeks later the vision was 20/30 and the eye was normal except for a few vitreous opacities. F. M. Crage.

Olsson, G. F. A common species of clinically observable spontaneous cysts in the anterior uveal tract. Acta Ophth., 1944, v. 22, pt. 4, pp. 319-340.

The literature is reviewed and 15 cases of spontaneous cysts situated on the posterior surface of the iris are re-

ported. Twelve of the patients were women, and no patient was older than fifty years. There were no symptoms of irritation. The cysts produced a slight elevation on the anterior surface of the iris, and they could be seen on the posterior surface only after maximal dilatation of the pupil. The pigmentation of the walls of the cysts varied in intensity from slight to very great. The origin of the cysts is discussed; the author believes that the faintly pigmented ones originate from a circumscribed separation of the limitans iridis, and the highly pigmented cysts are formed by the pigment epithelium. Usually no therapy is indicated. (2 photographs.) Ray K. Daily.

Pirie, A., and Simpson, D. Preparation of a fluorescent substance from the eye of the dogfish, *Squalus Acanthias*. Biochem. J., 1946, v. 40, no. 1, pp. 14-20.

A method is described for the preparation of a blue fluorescent material that is largely confined to the choroid, with perhaps traces in the iris. Chemical and spectroscopic evidence makes it probable that the substance is xanthopterin and not ichthyopterin. A similar substance was found in the eyes of Alligator Mississippiensis. The presence of guanine in the choroidal tapetum was confirmed. (1 figure, 1 table, references.) Bennett W. Muir.

Vidal, F. and Malbrán, J. Studies on the chemical composition of the aqueous humor of the cat. VII. pH. Arch. de Oft. de Buenos Aires, 1943, v. 18, Oct., p. 506.

The authors studied the pH of the aqueous humor of the cat. The determinations were calculated with v. Brehmer's hemo-ionometer using an electrode of quinidrone which allows

measurements of the pH between 6 and 8.5. The average figure in 19 eyes was 7.51 for aqueous of first formation and 7.52 for aqueous of second formation. The pH of the aqueous humor in cats is more alkaline than that of the blood in the same animal. Under abnormal conditions the authors obtained slightly higher figures, 7.55 and 7.57. (Tables, bibliography.) Plino Montalván.

Zeeman, W. P. C. The diagnosis of a flat sarcoma of the choroid and the histological substratum of the changes observed with the ophthalmoscope. *Acta Ophth.*, 1943, v. 21, pts. 1-2, pp. 47-60.

A clinical and histo-pathological report of a case, correlating the ophthalmoscopic picture with the microscopic changes. Reference is made to a case reported by Meller as a pseudosarcoma choroidea and the correctness of his diagnosis is questioned. To support his contention that Meller's case was a sarcoma the author describes and illustrates the microscpic findings in an enucleated globe similar to the one reported by Meller. In this case the extension of the tumor along a ciliary nerve left no doubt as to its identity. (8 illustrations.) Ray K. Daily.

8

GLAUCOMA AND OCULAR TENSION

Cristini, G. Alterations of general arterial pressure as a factor in the causation of glaucoma. *Rassegna Ital. d'Ottal.*, 1946, v. 15, March-Apr., pp. 125-143.

Cristini stresses the need to study the variations of the general circulation in the evaluation of the tension in glaucoma. He reviews the present knowledge of the circulatory and nervous physiology of the uvea and its relation-

ship to the regulation of the tension of the eye. Twenty patients with glaucoma were tested. The systolic blood pressure and the ocular tension after inhalation of amyl nitrite, after withdrawal of 500 c.c. of blood, and after compression of the eyeball were recorded. The author concludes that alterations in both the arterial and venous vessels of the uvea are fundamental causes of chronic glaucoma. This hypothesis is supported by the diverse response to hypotensive substances in glaucoma patients.

Eugene M. Blake.

Gallenga, Riccardo. Operative treatment of hydrophthalmos. *Rassenga Ital. d'Ottal.*, 1946, v. 15, May-June, pp. 161-164.

The writer finds that the removal of the lens is the best treatment for congenital glaucoma. After dilating the pupil with atropine he divides the capsule and lens fibers with a double-edged knife. Four to eight days later he extracts the swollen lens matter by aspiration, through a small opening at the limbus above. For anesthesia chloral hydrate and a retrobulbar injection of novocain without adrenaline are used.

Four patients were operated upon by the above technic with satisfactory results and all were under four years of age. Gallenga feels that the lens is an etiologic factor in buphthalmos, and its removal is indicated for the same reason that this treatment is helpful in congenital aniridia and in high myopia.

Eugene M. Blake.

McDonald, Phillip Robb. Treatment of glaucoma with di-isopropyl fluorophosphate. *Amer. Jour. Ophth.*, 1946, v. 29, Sept., pp. 1071-1081. (9 figures, 1 table, references.)

Oezerengin, T. Two cases of congestive glaucoma with acute rheumatism. *Göz Kliniği*, 1945, v. 3, no. 3, pp. 35-39.

The author presents his observations on two women who developed congestive glaucoma during their convalescence from acute rheumatism. One woman is suffering from "confusion of the endocrines" and the other hypertension. He believes the glaucoma is caused by an allergic response to the infection. I. E. Gaynon.

Penido Burnier, Jr. Threshold of ocular tension. *Arquivos do Instituto Penido Burnier*, 1945, v. 7, Dec., pp. 168-177.

A man aged 52 years came complaining of failing vision. The corrected vision of the right eye was 0.3, that of the left eye 0.7. Ophthalmoscopy showed marked excavation of the optic discs, extending to the disc margins and accompanied by pallor which was more evident in the right eye. The tension of the right eye with the Schiötz instrument was 17 mm., the tension with the McLean instrument 32 mm. The fields were somewhat contracted, and the right eye had a typical Bjerrum scotoma. Reduction of tension with miotics, to something like 3 or 4 mm. (Schiötz), caused some improvement in vision. (7 illustrations, including 4 pairs of visual fields.) W. H. Crisp.

Penido Burnier and Souza Queiroz. Familial glaucoma secondary to spontaneous, homochronous, and hereditary dislocation of the crystalline lens. *Arquivos do Instituto Penido Burnier*, 1945, v. 7, Dec., pp. 57-75.

The authors give the histories of four patients, three brothers aged 45,

65, and 50 years respectively, and a cousin of the three aged 52 years. All four developed subluxation of the crystalline lenses, followed by acute glaucoma. Iridectomy did not relieve the glaucoma, but the ocular tension became normal after extraction of the dislocated lens. On the whole the visual results were good after operation, although one patient was less fortunate in this respect because he at first refused extraction of the lens. The authors describe and illustrate the genealogic tree of the affected family, showing 11 positive out of 18 individuals in three generations. The authors agree with Vogt, who presented a similar family record, in attributing the spontaneous dislocation to presenile degeneration of the zonula, hereditary in character. Intracapsular extraction is regarded as the treatment of choice. (Bibliography.)

W. H. Crisp.

Regoli, Attilio. The consensual ophthalmotonic reaction. *Boll. d'Ocul.*, 1944, v. 23, July-Sept., pp. 129-165.

A summary of the subject as it appears in the literature precedes the article. The author reports in tabulated form the results obtained in patients and rabbits. In his own experience the reaction manifests itself after such procedures as paracentesis of the anterior chamber, galvano-cauterization of the sclera, antiglaucomatous procedures, enucleation of the globe, and surgical procedures on the lacrimal passages. The reaction is probably a reflex phenomenon based on vascular changes which, through centers and associated fibers of a vasomotor system is transmitted consensually to the other eye. (Bibliography.)

Melchior Lombardo.

Riise, Per. Experiences with Holth's iridencleisis. *Acta Ophth.*, 1943, v. 21, pts. 1-2, pp. 31-46.

This is a detailed analysis of 199 iridencleisis operations performed on glaucoma patients. Normalization of tension, relation of tension to visible filtration, immediate and late postoperative complications, conservation of central and peripheral visual acuity, and postoperative refractive changes are considered. The material comprises acute, secondary, and chronic simple glaucoma, and its value lies in the fact that all the eyes were operated on and followed by one surgeon.

Ray K. Daily.

9

CRYSTALLINE LENS

Broendstrup, Poul. Amblyopia exanopsia in infantile cataract. *Acta Ophth.*, 1944, v. 22, pt. 1, pp. 52-71.

The author reviews the literature and gives a detailed analysis of his own material which comprises 29 cases of unilateral spontaneous cataract, congenital or acquired before the tenth year, and 48 cases of unilateral traumatic cataract acquired before the tenth year. The data show that amblyopia exanopsia vitiates the surgical result of operation for cataracts acquired in early childhood. Functional amblyopia in infantile cataract is very widespread, and is not influenced significantly by removal of the cataract; uncorrected aphakia does not counteract the amblyopia, and may accentuate it. The prognosis for visual acuity is therefore not influenced by early or late operation. Amblyopia exanopsia is apt to develop as a sequel to traumatic anopsia incurred before the eighth year of life. If the cataract appears after the eighth year of life functional amblyopia is not apt to develop.

Ray K. Daily.

Broendstrup, Poul. Operative results obtained in bilateral infantile cataract. *Acta Ophth.*, 1945, v. 23, pt. 2, pp. 175-194.

The literature is reviewed, and the author's material of 155 cases is subjected to a detailed analysis. The data show that bilateral infantile cataracts fall into two groups: stationary partial, and dense cataracts. There is danger of amblyopia exanopsia if partial cataracts are treated surgically too early. Infants with dense cataracts, if not operated upon early, will face the same fate as children born blind. Of 132 children with partial cataracts who were operated upon during their first school years 85 percent had a visual acuity of 6/18 or better during in the best eye. The best visual results were obtained in eyes in which good function could be determined preoperatively, and which were not operated upon too early. The results indicate that surgical intervention before the age of seven years may lead to irreversible amblyopia exanopsia.

There were 23 cases of bilateral congenital dense cataract. This type of cataract is frequently associated with other ocular anomalies that preclude good vision. Such eyes are apt to develop postoperative complications. A visual acuity of 6/36 is considered to be a good result. These patients should be operated upon at the age of one year, and should be given a refractive correction as soon as possible.

Ray K. Daily.

Broendstrup, Poul. The squinting position of weak-sighted eyes. *Acta Ophth.*, 1944, v. 22, pt. 4, pp. 386-393. (See Section 4, Ocular movements.)

Gilje, Kristian. Has saturation with ascorbic acid any influence upon hem-

orrhage after cataract operation? *Acta Ophth.*, 1945, v. 23, pt. 2, pp. 127-134.

The material of this study consists of 45 patients who were operated upon for cataract during March, April, and May, 1941. The patients were saturated with ascorbic acid before operation and for 10 days after. No effect on the incidence of post-operative hemorrhage could be ascertained. The author's findings therefore do not confirm Urbanek's contention that saturation with ascorbic acid protects against postoperative hyphema. Ray K. Daily.

Mihalyhegy, G. Foreign body injury of the lens. *Ophthalmologica*, 1945, v. 109, Feb.-March, pp. 159-163.

A glistening foreign body was found in the lens of a non-irritated eye of a soldier after an explosion. X-ray examination was negative. It was found that the foreign body was gun powder which is insoluble in the aqueous and the tissue of the lens and, therefore, did no chemical harm. As the tear in the lens capsule closed immediately after the injury, no traumatic cataract ensued and final vision was 6/7.

Max Hirschfelder.

Rivas Cherif, Manuel de. Anesthesia in the cataract operation. *Anales de la Soc. Mex. de Oft.*, etc., 1945, v. 20, July-Sept., pp. 93-102.

A general discussion of the varying practice of different authors regarding local anesthesia. W. H. Crisp.

Rocha, Martins. Concerning microphakia. *Arquivos do Instituto Penido Burnier*, 1945, v. 7, Dec., pp. 151-160.

The author records three cases, in a girl aged two years, and in two brothers aged respectively three and two years. Of the latter two patients the

parents were first cousins and had three children. The lenses were extracted, apparently with good result. (3 figures, references.) W. H. Crisp.

10

RETINA AND VITREOUS

Andersen, O. C. Three cases with remains of the hyaloid artery and anomalies of the retinal vessels. *Acta Ophth.*, 1944, v. 22, pt. 3, pp. 270-274.

The interesting feature of these cases is the inferior temporal direction of the vascular band, which is rare. In the first case there were also remains of the tunica vasculosa lentis on the posterior surface of the lens. The second case had two fibrous bands; in addition to the one coursing, through the vitreous, as is usual, there was another one situated on the surface of the retina. Such formations are very rare. In addition, these eyes also had anomalies of the fundus vessels. In the first patient there were no vessels in the fundus; in the second the arteries were very narrow and in the superior portion of the retina the vessels were scarce and thin. A similar fundus picture was seen in the third patient, except that the lower portion of the fundus was almost normal. The optic disc was pale in all of them and function was correspondingly reduced, no doubt because of the inadequate blood supply. Ray K. Daily.

Bangerter, A. Contribution to the diagnosis, differential diagnosis and therapy of cystoid edema of the macula (macular cysts). *Ophthalmologica*, 1945, v. 109, Feb.-March, pp. 102-122.

Macular cysts, the pathologic existence of which has been known for a long time, were first clinically recognized by Vogt who employed red-free ophthalmoscopy for their detection. He

described the clinical picture as "honey-comb macula". Whereas the usual ophthalmoscopic examination with white light reveals only the very advanced cystoid changes, it is possible to recognize very small and early cysts by slitlamp observation with use of the fundus contact glass. These small cysts are missed by any other method. The article describes in detail the slitlamp appearance of the cystoid macula and its differentiation from a hole in the macula and from the picture produced by degeneration due to sclerosis of the choroid. One group of Bangerter's patients with cystoid degeneration also showed senile choroidal sclerosis. It was in this group that a new treatment with retrobulbar injection of atropine sulfate (1 : 1000 solution, 0.3 to 0.6 c.c., two to four times per week for 12 injections) seemed effective. The author proposes this treatment with the idea that retrobulbar vasodilation improves the nutritional disturbance of the macular area which causes the formation of cysts. A second form of macular cysts was found in patients suffering from retinal detachment, branch thrombosis of retinal veins, retinitis pigmentosa, and inflammatory intraocular changes. These did not respond as regularly as those in the senile group to the treatment with retrobulbar injection of atropine. (Photographs, literature.) Max Hirschfelder.

Broendstrup, Poul. **Ablatio falciformis congenita**. *Acta Ophth.*, 1944, v. 22, pt. 2, pp. 193-202.

In 1936 Weve reported under this name eight cases of a familial congenital anomaly. The characteristic feature of the anomaly is a double retinal layer which extends as a sickle from the papilla to the region between the ciliary

body and the lens. The author reports the case of 4½-year-old girl who had this anomaly in the right eye, and a coloboma of the choroid in the left. (2 illustrations.) Ray K. Daily.

Brueckner, R., and Field, N. H. **Contribution to the complex of symptoms in chorioretinitis centralis serosa** (Kitahara). *Ophthalmologica*, 1945, v. 109, June, pp. 281-317.

Chorioretinitis centralis serosa is characterized by a sharply limited, flatly detached area in the macular region. The changes may be minute and the area has the form of a circle or of an ellipse. Numerous small yellowish spots are usually found in the area after three to five weeks. Their histologic significance is not clear. The visual acuity is somewhat diminished, there is alteration in the sense of color perception, micropsia, and metamorphopsia. The condition usually clears up after weeks or months with complete return of the visual acuity. The existing relative central scotoma disappears. However, recurrences are common. The authors observed three patients who had the typical complex of symptoms and findings. They believe that edema has an important part in the pathogenesis of the condition and that it arises in the choroid, whereas the retina becomes detached and invaded by the fluid secondarily. It must be assumed that there is a pathologic change in the permeability of the capillaries of the choroid. No definite cause has been found nor has therapy been successful. The relative scotoma was extensively studied by one of the patients and his drawings which accompany the article are correlated with the clinical findings. There were certain unusual color images and afterimages

within the scotomatous area that varied during the clinical course depending on the intensity of the pathologic changes. With diascleral transillumination a positive scotoma appeared in the entoptic image. During autofunduscopy by the patients a small light reflex that changed its position with the moving of the transilluminating lamp, was noted in the positive scotoma. The authors call it the "entoptic reflex of convex retinal surface" and discuss its theoretical basis. (3 color plates, drawings, references.)

Max Hirschfelder.

Brueckner, R. **A case of thrombosis of the central retinal vein after a trauma.** *Ophthalmologica*, 1945, v. 109, Apr.-May, pp. 203-211.

A typical thrombosis of the central retinal vein was found in an eye that had suffered two contusions a few weeks before. It was assumed that the sudden increase of pressure in the central retinal vein lead to tears in its intima and gave rise to the slow formation of a thrombus. Brueckner discusses the physical and physiologic aspects that lead him to believe that there was a connection between the contusion and the thrombosis. The state insurance service recognized his considerations as a basis for assuming liability.

Max Hirschfelder.

Cardello, G. **A case of retinal periphlebitis.** *Rassegna Ital. d'Ottal.* 1946, v. 15, no. 1 and 2., p. 56.

The patient described was a 23-year-old woman whose physical and laboratory tests were all negative, except for a strongly positive tuberculin reaction. The retinal changes observed were sheathing, constrictions, and dilatations of the veins of medium and smaller

caliber. Extensive hemorrhages were present but vision was 6/6. Tuberculin therapy was not feasible but recovery followed the use of calcium, arsenic, vitamin C, and auto-hemotherapy. Tuberculosis was the assumed cause. (4 figures.) Eugene M. Blake.

Colvin, Clifford. **Detachment of the retina.** *M. J. Australia*, 1946, v. 2, July 20, pp. 80-83.

The author discusses the etiology and pathology of retinal detachment. He recommends transillumination of all eyes. At operation the detached area of the retina is projected on to the sclera and marked with India ink. After the conjunctiva has been reflected, a spot of light from the ophthalmoscope is easily visible. A mark is made on the sclera 8.8 mm. from the limbus in the approximate meridian of the tear. Surface diathermy with the Larsson electrode is used. Case reports are included.

I. E. Gaynon.

Conte, W. R., McCammon, C. S., and Christie, A. **Congenital defects following maternal rubella.** *Am. J. Dis. Child.*, 1945, v. 70, Nov.-Dec. p. 301.

The authors questioned the mothers of 120 infants who were born with congenital abnormalities during a five year period ending 1944. Of this group, five mothers reported having had rubella, four of them in the first trimester of pregnancy. Four of the five infants had congenital cataracts. The incidence of rubella in these mothers was at least ten times that of the rubella morbidity in the female adult population generally. It is felt that this constitutes evidence that rubella in pregnancy is a predisposing cause of congenital defects.

The authors found, as have all pre-

vious investigators, that most of the mothers reporting rubella had the disease in the first trimester of pregnancy.

Benjamin Milder.

Gil, R. R., and Blaza, J. F. Retinal detachment in a pregnant woman. *Arch. de Oft. de Buenos Aires*, 1943, v. 18, Oct., p. 531.

A case of retinal detachment occurring in the third month of pregnancy is reported. The pregnancy was uncomplicated and the eyes were highly myopic. The detachment was not related to the pregnancy. The patient was operated on and several diathermic punctures made to seal the retinal tears. Recovery was uncomplicated and vision was considerably improved. The pregnancy progressed to term uneventfully. (Illustrations and bibliography.)

Plinio Montalván.

Gradle, H. S. Surgical treatment of retinal detachment. *Anales Argentinos de Oft.*, 1945, v. 6, Apr.-May-June, pp. 53-59.

The author feels that preoperative therapy is extremely important in achieving a satisfactory surgical result. For five to ten days the patient is immobilized in a position favoring approximation of the separated tissues, atropine is instilled, and the eyes are covered. Occasionally, even a satisfactory operation does not result in increased visual acuity, owing to macular degeneration or cyst formation. If the retinal tear is sealed, the chance for recovery is much enhanced, therefore, an intensive search for the site of a tear must be made. If a tear is not seen at first, it may appear at a later examination, after the patient has rested, because of a shift or absorption of sub-retinal fluid. The author prefers to use the electrodiathermy needle that he de-

scribed in 1935. He makes a complete puncture of the sclera with a current of fifty to seventy milliamperes. He observes the fundus during this procedure, between penetrations, to make certain that they are properly placed. The sub-retinal fluid must be drained to achieve a proper chorioretinal cicatrix. Occasionally some months may pass before a good adhesion occurs, because of slow absorption of the remaining sub-retinal fluid. He reports good anatomic results in 54 to 74 percent of his operations, and good functional results in only thirty-seven percent in the past six years. (2 illustrations.)

Edward Saskin.

Hertzberg, R. Quinine amaurosis. Report of a case. *M. J. Australia*, 1946, v. 2, July 20, pp. 92-93.

The patient noted that after taking 50 grains of quinine sulfate, his vision became blurred and on the third day he was unable to see at all. Atabrine was substituted for quinine and the next day vision began to return. The pupils were dilated and immobile, there was edema of the macula in each eye and the fields were normal. Two days later the discs became pale and the arteries attenuated. After two weeks the visual acuity became 6/6 and the pupillary reactions normal, although the vessels were still attenuated and the discs pale.

I. E. Gaynon.

Lijó Pavia, J., and Lachman, R. Macula. Small hole due to photo-traumatism. Considerations on two cases. *Arch. de Oft. de Buenos Aires*, 1943, v. 18, Oct., p. 496.

The authors report two cases of solar eclipse retinitis in which typical holes of the macula were observed. A small central scotoma with subnormal vision

remained after recovery. The literature on the subject is briefly discussed and the authors stress the traumatic action of light on the forvea when the luminous rays are converging on the macular region. The article is illustrated.

Plinio Montalván.

Lyle, D. J. Early ocular manifestations in the Laurence-Moon-Biedl syndrome. *Amer. Jour. Ophth.*, 1946, v. 29, pp. 939-945. (1 table, 3 figures, references.)

Johnson, H. C. Retinal venous sheathing in multiple sclerosis; report of a case. *Amer. Jour. Ophth.*, 1946, v. 29, Sept., pp. 1150-1151. (See section 17, Systemic diseases and parasites.)

Manschot, W. A. The fundus oculi in subarachnoid hemorrhage. *Acta Ophth.* 1944, v. 22, pt. 3, pp. 281-299.

The author reports three cases of subarachnoid hemorrhage accompanied by hemorrhages in the fundus of each eye. The eyeballs and optic nerves were examined microscopically, and Manschot finds in the microscopic picture an explanation for the extensive form which these hemorrhages assume in the retina, and which distinguishes them from the smaller retinal hemorrhages of different etiology. The anatomic data indicate that the hemorrhage is caused by a complete occlusion of the central retinal vein in the intervaginal space. The suddenness of the occlusion and the pressure within the optic nerve driving the venous blood in a retrograde direction creates such a high pressure within the retinal veins that they rupture and produce the large hemorrhages characteristic of subarachnoid hemorrhage. The smaller hemorrhages seen in thrombosis of the central retinal vein and in papilledema are formed by dia-

pedesis in a slowly developing stasis in the retinal veins, which rarely causes their rupture. (5 microphotographs.)

Ray K. Daily.

Nyquist, B. Two cases of retinitis as a complication in acute infections during chemotherapy. *Acta Ophth.*, 1943, v. 21, pt. 1-2, pp. 61-67.

One occurred in a patient whose erysipelas was treated with sulfanilamide. Blurring of vision occurred simultaneously with jaundice and exanthema after the patient ingested 7.5 gm. of the drug. The fundus had a small white spot up and temporally from the papilla. Recovery was complete, and treatment consisted in rest and dark glasses. The patient who had pneumonia, developed serious blurring of vision after taking 20 gm. of sulfathiazole in the course of five days. He had a bilateral central retinitis with large central scotomata. The exudates were gradually absorbed, and the final result was an absolute central scotoma one degree in diameter, and visual acuity of 5/35. (2 photographs.)

Ray K. Daily.

Nano, J. M., and Cuille, E. Obstruction of the central artery of the retina not affecting the macular area. *La Semana Med.*, 1946, May 9, 53d yr. p. 835.

The macular area had escaped, as usual, on account of the existence of cilioretinal vessels. Retinal photographs show the contrast between the normal color of the preserved macular area and the pale edematous appearance of the rest of the fundus. The central vision of the other eye was two thirds, that of the involved eye one half. There are also a fundus drawing and two visual fields. (References.)

W. H. Crisp.

PAN-AMERICAN NOTES

Edited by DR. M. URIBE TRONCOSO
500 West End Avenue, New York 24

Communications should reach the editor by the 12th of the month

SOCIETIES

The Sociedade de Oftalmologia de São Paulo has elected the following officers to serve during the fiscal year 1946: President, Dr. Armando Gallo; Vice President, Dr. Jose Mendonça de Barros; General Secretary, Dr. Amedée Peret; Secretary, Dr. Paulo Aranha; Treasurer, Dr. Aureliano Fonseca.

The prize offered annually by the Sociedade de Oftalmologia de São Paulo was won this year by Dr. José de Freitas, graduate of the University of Minas Geraes. This prize was offered to doctors who, having graduated the year before from a recognized medical school, wish to specialize in ophthalmology. It is awarded on the merits of a 10-minute dissertation on one of 20 subjects which have previously been studied by the candidate, one of these being drawn by lot on the night of the prize giving.

During the month of December, 1945, Prof. Edmond Velter, the well-known French ophthalmologist, visited São Paulo. Prof. Velter read a paper at a meeting of the Sociedade de Oftalmologia de São Paulo, and the São Paulo ophthalmologists gave a dinner for him at which Dr. Pereira Gomes made a speech of welcome on behalf of his colleagues. Prof. Velter, accompanied by Dr. Herdocia, of Costa Rica, and Dr. Cintra Gordinho, of São Paulo, then left for Campinas where they visited the ophthalmologic services and were given the opportunity of visiting a coffee "fazenda" in which they were greatly interested.

The Fifth Brazilian Congress of Ophthalmology is scheduled to convene in Salvador, Bahia, from June 28 to July 2, 1947. The following papers are included in the program: "Vision of Vehicle Drivers," by Dr. Pereira Gomes, São Paulo; "Abiotrophic Diseases of the Macula," by Dr. Carlos Damel, Buenos Aires; "Vitamins in Ophthalmology," by Dr. Joviano de Rezende, Rio de Janeiro; (this paper will be discussed by Dr. Geraldo Queiroga, Belo Horizonte, and Dr. Heitor Marback, Bahia; "Glaucoma," by Dr. Renato de Toledo, São Paulo; (this paper will be discussed by Dr. Jacques Tupinambá, São Paulo, and Dr. Ruy Rolim, Rio de Janeiro. Surgical demonstrations will also be given during the meeting. The local committee has arranged a program of excursions

and visits to places of interest in Salvador.

Dr. Saul Fontoura has been elected President of the Sociedade de Oftalmologia e Otrrinolaringologia do Rio Grande do Sul for 1946.

The Sociedad Cubana de Oftalmología has elected the following officers who will serve until January 1948: President, Dr. Lorenzo Comas; Vice Presidents, Dr. Rodolfo Hernández and Dr. Miguel Mery; Treasurer, Dr. Candido Durán; Secretary, Dr. Oscar Horstmann, and Vice Secretary, Dr. Tomas R. Yanes. At its first meeting in 1946 the Society agreed to hold the First National Congress of Ophthalmology in January 1947, with a symposium on the surgical treatment of cataract.

The first Congress of Medicine in Mexico was held in Mexico City from August 4 to 10, 1946. Although the Mexican Medical Association had held meetings since 1931, the association was transformed into a medical syndicate and, during the war, meetings were suspended. This first postwar Congress was held under the auspices of the Medical Society of the General Hospital and was very well attended. Important papers were read in the sections of Medicine, Hematology, Micro-Biology, Parasitology, Pathology, and Allergy.

The first Pan-American Congress of Otorhino-Laryngology and Broncho-Esophagology was held at the Palmer House, on October 17, 18 and 19, 1946. It was sponsored by the American Academy of Ophthalmology and Otolaryngology. The Latin-American participants were invited to attend the meeting of the American Academy which opened on Sunday, October 15th. The inaugural session of the Pan-American Congress took place on the night of October 17th with a Pan-American dinner, and the first scientific meeting was held jointly with the final session of the Academy on the morning of October 18th.

The Sociedad Cubana de Oftalmologia has started work on the organization of the third Pan-American Congress of Ophthalmology which is scheduled to convene in Havana in February, 1948. The Cuban government will provide all the necessary facilities and sponsor the event, as the importance of this meeting is well recognized by all.

MISCELLANEOUS

The second number for 1945 of the publication, *Estudios de Informaciones Oftalmológicas* contains the following articles: B. Perpiña Robert, "Blue Sclerotics"; I. Barraquer, "Sclerocorneal Suture in Cataract Operations"; J. Barraquer Moner, "New Method of Corneal Section in Total Extraction of Cataract"; R. Almeida Ribeiro, "Congenital Cataracts and Phacolysis." These papers are illustrated with beautiful figures.

PERSONALS

Dr. A. Moreu. *El Problema del Glaucoma Verum* (The Problem of Glaucoma Verum): The distinguished Spanish ophthalmologist, Dr. Moreu, of Valencia, has just published an interesting book of 336 pages with numerous illustrations dealing with ocular tension, primary and secondary glaucoma and their treatment, both medical and surgical. Although a review of this book is forthcoming, we want to point it out to all those ophthalmologists who speak Spanish.

NEWS ITEMS

Edited by DONALD J. LYLE, M.D.
904 Carew Tower, Cincinnati 2

News items should reach the editor by the 12th of the month

DEATHS

Dr. Mary Buchanan, Philadelphia, Pennsylvania, died August 8, 1946, aged 76 years.

Dr. Thomas Edward Carmody, Denver, Colorado, died August 27, 1946, aged 71 years.

Dr. Robert K. Lambert, New York, New York, died October 3, 1946, aged 47 years.

Dr. Richard Joseph Tivnen, Chicago, Illinois, died August 27, 1946, aged 71 years.

MISCELLANEOUS

The Division of Ophthalmology of the University of California announces the receipt of a gift of \$20,000 donated by Mrs. Francis I. Proctor for the establishment of a yearly lecture in ophthalmology in memory of her husband. The first Francis I. Proctor Lecture will be given on Friday, December 20th, at the University of California Medical School in San Francisco by Dr. Kenneth Swan of the University of Oregon. His subject will be "Some Contemporary Concepts of Pharmacology and Toxicology of the Cornea." The lecture is open to all ophthalmologists.

Dr. Francis I. Proctor was born in Boston in 1864. After his preliminary education, he attended and was graduated from the Harvard University Medical School in 1892. Following graduation, he went into the specialty of ophthalmology and eventually became Chief Surgeon of the Massachusetts Eye and Ear Infirmary.

On retirement he settled in Santa Fe, New Mexico, and became consultant in ophthalmology to the Office of Indian Affairs. While here, he became interested in trachoma, and it was he who induced Noguchi to make his studies in trachoma. When Thygeson was unable to con-

firm Noguchi's work, Dr. Proctor went to Denver to interview Thygeson and this established a friendship that lasted until his death. After Noguchi's death, it was Dr. Proctor who stimulated and participated in the work that was eventually to establish a filterable virus as the causative agent of trachoma. In addition, it was Dr. Proctor's generosity and determination that made possible the final confirmation of the etiology of trachoma. While Dr. Proctor did very little of the original work on trachoma, he traveled the world over to interview personally all who were doing outstanding work in the field, and it was his enthusiasm and encouragement that made possible the final solving of this problem.

It was Dr. Proctor's interest in furthering ophthalmology in the western part of the United States that resulted in the establishment of this lecture on the Pacific Coast. It is the plan of the Division of Ophthalmology to have one of the outstanding figures in the field of ophthalmology deliver the lecture each year.

The Ophthalmological Study Council opened its second course at the Hotel Soreno, St. Petersburg, Florida, on November 2nd. The course will continue through January 15th. Included among those presenting the basic subjects in the field of ophthalmology are:

Dr. Joseph Igersheimer, Boston, November 4-12, Sensory Neuro-Ophthalmology perimetry.
Dr. Herman Burian, Boston, November 13-23, Motor Neuro-Ophthalmology.

Dr. Georgiana Theobald, Oak Park, Illinois, November 25-30, General Pathology and Special Pathology.

Drs. Everett Goar, Dallas; Milton Berliner, New York; Robert Masters, Indianapolis; and Harvey E. Thorpe, Pittsburgh, December 2-7, Slitlamp Biomicroscopy.

Dr. Placidus J. Leinfelder, Iowa City, December 9-11, Practical Perimetry in Sections.

Dr. Algernon Reese, New York, December 12-14, Pathology—Tumors.

Dr. Cecil O'Brien, Iowa City, December 16-21, Surgical Principles, Pathology, Retina, Choroid and Optic Nerve and Ophthalmoscopy.

Drs. Walter B. Lancaster, Boston; Paul Boeder, Southbridge, Massachusetts; and Arthur Linksz, New York, November 4-16, Optics, Visual Physiology.

Drs. S. Judd Beach, Portland, Maine; James J. Regan, Boston; and W. B. Lancaster, Boston, November 18-27, Refraction Theory and Practice.

Dr. Trygve Gunderson, Boston, November 28-December 5, Pathology of Cornea and External Diseases.

Dr. Phillips Thygeson, San Jose, California, December 6-14, Bacteriology.

Dr. Albert N. Lemoine, Jr., Kansas City, Missouri, December 16, Anatomy, Histology, Embryology, Heredity.

Dr. Peter Kronfeld, Chicago, January 1-9, Pharmacology.

Dr. Paul Chandler, Boston, January 10-13, Glaucoma.

V. Everett Kinsey, Ph.D., Boston, January 1-9, Biochemistry.

Dr. Henry Wagener, Rochester, Minnesota, January 10-15, Medical Ophthalmology and Ophthalmoscopy.

Additional information may be obtained from Dr. Walter B. Lancaster, 520 Commonwealth Avenue, Boston.

An eye clinic on wheels was dedicated in special ceremonies at Trenton, New Jersey, October 12. The unit is said to be the first mobile clinic for providing eye care in remote areas in the country. Nineteen feet long and more than 6 feet wide, the unit contains a refracting chair, refractor, slitlamp, retinoscopes, and ophthalmoscopes. Diagnosis of eye diseases, minor treatments and operations, along with examination of eyes for glasses can now be made readily available in all areas. The new eye clinic is similar to the mobile optical units used overseas by the armed forces.

The Department of Ophthalmology, University of Toronto, has undertaken post-graduate training during the past year. This has been aided by a generous annual grant from Mr. Percy Hermant for establishing Fellowships in Ophthalmology. The post-graduate training is now three years for the Fellows. The first

year's work is in the basic sciences of Ophthalmology, and the final two years are spent in clinical internships in one of the Toronto hospitals. Dr. J. R. Gaby, Toronto, and Dr. A. W. Mahood, Vancouver, have been appointed Fellows for the current year. In addition to the Fellows, there are a number of two-year clinical internships in Ophthalmology.

The graduate instruction in Ophthalmology in the hospitals in Toronto has been coordinated under the direction of the University. Didactic lectures are presented weekly from October until May to the internes by the members of the teaching staff in Ophthalmology. On Saturday mornings, ward rounds are made at the Toronto General Hospital and are attended by the internes in Ophthalmology from the various hospitals.

The internes are rotated through the Department of Ophthalmology of the Hospital for Sick Children in order that they may become familiar with the medical and surgical procedures of children's Ophthalmology.

The senior internes are given instruction in the preparation and presentation of scientific papers, and each one presents a paper at the Toronto Academy of Medicine, Section of Ophthalmology.

There have been a number of changes in the teaching staff in the University Eye Department. Dr. Walter W. Wright has retired as Professor of Ophthalmology in the University and Head of Ophthalmology in the Toronto General Hospital. He has been appointed Professor Emeritus. Dr. A. J. Elliot succeeds Dr. Wright. Dr. A. E. MacDonald and Dr. A. Lloyd Morgan have been made Assistant Professors of Ophthalmology and the teaching staff of the university department has been increased by the appointments of Dr. J. S. Crawford, Dr. C. E. McCulloch, Dr. J. C. Hill, and Dr. M. E. Albertson.

The George Washington University Department of Ophthalmology is planning the resumption of the intensive post-graduate courses in Ophthalmology, the next course to be given the week of February 3 to 8, 1947. These courses were discontinued during the war. The following guest lecturers are assisting the resident staff on the program: Dr. F. Heed Adler, Philadelphia; Dr. J. Mason Baird, Atlanta; Dr. S. Judd Beach, Portland, Maine; Dr. Herman M. Burian, Boston; Dr. Ramon Castroviejo, New York; Dr. C. Alvin Clapp, Baltimore; Dr. F. Bruce Fraclick, Ann Arbor, Michigan; Dr. Deane B. Judd, Washington, D.C.; Dr. Peter C. Kronfeld, Chicago; Dr. Walter I. Lillie, Philadelphia; Dr. Angus L. MacLean, Baltimore; Mr. Philip L. Salvatori, New York; Dr. Harold G. Scheie, Philadelphia;

Dr. Edmund B. Spaeth, Philadelphia; Dr. Frederick W. Stocker, Durham, North Carolina.

The 10th annual post-graduate course in ocular surgery, pathology, and orthoptics will be given during the week of January 27-February 1, 1947. This is a practical course and limited to 30 participants.

For further details write to the Secretary, Mary Everist Kramer, Suite 34, 1801 K Street N.W., Washington 6, D.C.

Plans for a new \$4,500,000, 10-story clinic hospital for the 126-year-old New York Eye and Ear Infirmary are outlined by Dr. Conrad Berens, superintendent, at the annual meeting of the infirmary's former internes, attended by 100 physicians at the University Club, 1 West 54th Street.

The hospital will adjoin the proposed New York University-Bellevue Medical Center between 30th and 34th streets on East River Drive, he said. He forecast completion in three to five years.

Amalgamated since February with the New York University-Bellevue Medical School, the infirmary has begun joint teaching and research activities with the school.

Dr. Currier McEwen, Dean of the New York University-Bellevue Medical School, told the alumni that identities of the two amalgamated institutions would be kept separate, although both would gain by their affiliation.

The opening address of the program was given by Dr. Conrad Berens. Mr. Hugh E. Paine, treasurer of the Board of Directors spoke on: "Mission of Trustees in Furthering Association of the Infirmary and New York University." Dr. Edward H. Cary, speaker of the evening, talked on: "Future Plans of the New York Eye and Ear Infirmary." Other guest speakers were: Dr. Daniel B. Kirby, Dr. J. Morrisset Smith, Dr. Joseph Kelly, Dr. Clyde E. McDannald, Dr. Bernard Samuels, and Dr. Edgar Burchell.

SOCIETIES

On Thursday, November 21st, Dr. Algernon B. Reese of New York delivered the ninth annual deSchweinitz Lecture at a meeting of the Section on Ophthalmology, College of Physicians of Philadelphia. Dr. Reese's subject was "Pigmented Tumors."

The Milwaukee Oto-Ophthalmic Society met on October 22nd at the Milwaukee Athletic Club. The program included a talk by Dr. Edward Waldeck on "Pulsating Exophthalmos—Presentation of a Case"; and a paper by Dr. Walter Reinking (by invitation) on "Practice of Otolaryngology in Mexico City."

Among the many interesting topics on the program of the 1946 conference of the National Society for the Prevention of Blindness, Inc., held at the Hotel Pennsylvania, New York, November 25th, 26th, and 27th were:

THE VISION PROGRAM IN INDUSTRY

Chairman: THOMAS D. ALLEN, M.D., Chicago, Member, Joint Committee on Occupational Ophthalmology, American Academy of Ophthalmology and Otolaryngology and American Medical Association.

1. Is Industry Measuring Up to Modern Standards of Eye Health and Protection? LEONARD GREENBURG, M.D., New York, Executive Director, Division of Industrial Hygiene and Safety Standards, New York State Department of Labor.

2. Professional Guidance in the Plant Program (Panel Discussion)

Discussion Leader: T. LYLE HAZLETT, M.D., Pittsburgh, Medical Director, Westinghouse Electric and Manufacturing Company. Medical Aspects, L. HOLLAND WHITNEY, M.D., New York, Director, Employee Health and Safety, American Home Products Corporation.

Ophthalmologic Aspects, HEDWIG S. KUHN, M.D., Hammond, Indiana, Secretary, Joint Committee on Occupational Ophthalmology, American Academy of Ophthalmology and Otolaryngology and American Medical Association.

Optometric Aspects, RICHARD REINBERG, O.D., Lafayette, Indiana, Industrial Vision Institute, Purdue University.

Optical Aspects, C. P. CARLSEN, New York, President, New York State Guild of Prescription Opticians.

Nursing Aspects, BETHEL J. McGRATH, R.N., Minneapolis, Industrial Nursing Consultant, American Association of Industrial Nurses.

DEVELOPMENTAL EYE CONDITIONS IN CHILDREN

Chairman: CONRAD BERENS, M.D., New York, Executive Surgeon in Ophthalmology, New York Eye and Ear Infirmary.

1. Congenital and Hereditary Conditions, HAROLD FALLS, M.D., Ann Arbor, Mich. Associate Professor of Ophthalmology, University of Michigan Medical School, and Associate Research Geneticist, Heredity Clinic, University of Michigan.

2. Retrolental Fibroplasia, PAUL M. RUNGE, M.D., Boston, Senior Clinical Assistant, Massachusetts Eye and Ear Infirmary.

3. Congenital Cataract Associated with German Measles, HERBERT MILLER, M.D., Kansas City, Kansas, Professor of Pediatrics, School of Medicine, University of Kansas.

Open Discussion.

MEDICAL ADVANCES IN RESTORING AND CONSERVING VISION

Chairman: R. TOWNLEY PATON, M.D., New York, Vice-President, Eye Bank for Sight Restoration, Inc.

1. Corneal Transplant (Talk with Motion Picture), HERBERT KATZIN, M.D., New York, Head, Laboratory of the Eye Bank for Sight Restoration, Inc.
2. Sulfa Therapy in Ocular Infection, FRED LOE, M.D., Carson City, Nevada.
3. Penicillin Therapy in Ocular Infections, RAYMOND G. INGALLS, M.D., New York, Assistant Ophthalmologist, Institute of Ophthalmology, Presbyterian Hospital.

GLAUCOMA CONTROL THROUGH COMMUNITY PROJECTS (PANEL DISCUSSION)

Chairman: WILLIS S. KNIGHTON, M.D., New York, Chairman, Committee on Glaucoma, National Society for the Prevention of Blindness, Inc.

Participants:

MARGARET R. OSTERMAN, Washington, D.C., Executive Director, D. C. Society for Prevention of Blindness.

EVELYN CARPENTER, Philadelphia, Pennsylvania, Director, Philadelphia Committee for Prevention of Blindness.

PETER KRONFELD, M.D., Chicago, Illinois Eye and Ear Infirmary.

JAY G. LINN, M.D., Pittsburgh, Falk Clinic, University of Pittsburgh.

DOROTHY HAMILTON, St. Paul, Executive Secretary, Minnesota Society for the Prevention of Blindness and Conservation of Vision.

ALVA TROTTER, New York, Social Worker, New York State Department of Social Welfare.

The Washington D. C. Ophthalmologic Society has elected the following officers: Dr. Richard W. Wilkinson, president; Dr. Edward J. Cummings, vice president; Dr. Jerome A. Sansoucy, secretary-treasurer; Dr. J. Thomas Schriebl and Dr. John R. Lloyd. ~~on Saturday~~ the executive ~~comids~~ are made at the Toronto

The dates of ~~and~~ are attended by the in-season are: Nov ~~ology~~, ~~March~~ 3rd, May 5th, and a special meeting February 3d, with the George Washington University post-graduate course. The meetings are held in the auditorium of the District of Columbia Medical Society Building, 1718 M Street, N.W. at 7:30: P.M.

PERSONALS

The Snyder Ophthalmic Foundation has given to Dr. K. W. Ascher a grant of two thousand dollars for research on aqueous veins at the College of Medicine, University of Cincinnati.

Dr. Richard C. Gamble has been appointed corresponding secretary of the Chicago Ophthalmological Society. He succeeds the late Dr. Robert Von der Heydt.

